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AN INVESTIGATION INTO THE
ACCURACY OF METROGON PHOTOGRAPHY.

CHARLES FREDERICK WILLETT

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AN INVESTIGATION INTO THE ACCURACY
OF METROGON PHOTOGRAPHY

A Thesis

Presented in Partial Fulfillment of the Requirements
for the Degree Master of Science

By

CHARLES FREDERICK WILLETT, B.A.
Lieutenant Commander, U. S. Navy

The Ohio State University

1959

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INTRODUCTION

The purpose of this thesis is to determine, by computation, the accuracy limitations of metrogon photography for use in stereo plotting instruments such as the Wild Autograph A7. This will be done by analyzing the error curves of lenses for which data can be obtained. These data will then be compared to a standard metrogon correction plate curve, as verified by observation, to determine residual errors. Then error curves within the stereo model will be constructed for X and Z coordinates and a y-parallax curve determined. Error curves from observation of an actual set of metrogon photographs will then be constructed and compared with the computed curves.

GENERAL DISCUSSION OF METROGON ACCURACY

In order to discuss the accuracy of metrogon photography, several letters were written to governmental agencies and metrogon lens manufacturers requesting data on these lenses. The only reply received with any usable information was from the National Bureau of Standards, enclosing data on all (25) metrogon lenses tested during fiscal year 1959.

The distortion values, which were taken from the original data, are tabulated in microns, normally the Bureau reports distortion values to the nearest ± 0.02 mm. These lenses were tested at their maximum aperture, f/6.3, and the measurements were made with a collimated incident light using a K-3 filter, a tungsten source and Eastman Kodak spectroscopic emulsion type V-F. Development was done in D-19 at 66°F for three minutes with continuous agitation. Tables I, II, and III are the tables of data provided by the National Bureau of Standards.

The data in Tables II and III are based on angular displacement from the principal point. This data was converted to radial distances in Table IV in order to provide a basis of comparison with the correction plate. The data of Tables III and IV were then used to construct the distortion curves of the best, average, and worst lenses, in Figures 5 through 8. These curves indicate the displacement of the image from the distortion free

THEORY OF THE EARTH'S CRUST

It is well known that the crust of the earth is composed of various layers of different materials. The uppermost layer is the crust proper, which is composed of igneous, sedimentary, and metamorphic rocks. Below the crust proper is the mantle, which is composed of igneous and metamorphic rocks. The lowermost layer is the core, which is composed of iron and nickel. The crust proper is the layer of the earth's crust that is exposed at the surface. It is the layer of the earth's crust that is composed of igneous, sedimentary, and metamorphic rocks. The mantle is the layer of the earth's crust that is composed of igneous and metamorphic rocks. The core is the layer of the earth's crust that is composed of iron and nickel.

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position. The abscissa indicates radial distance of the distortion free position from the photo center. A positive distortion value indicates a displacement away from center.

There has been considerable discussion concerning the establishment of a standardized calibrated focal length for metrogon lenses. Insofar as could be determined, there has been no formalized decision on this matter. It is apparent from the reconstructed curves of the 25 lenses that the National Bureau of Standards has adopted the calibrated focal length to produce zero distortion at the $42\frac{1}{2}^{\circ}$ circle, as all curves plot out through this point.

Table V is a table of lens distortions, based on radial distance in mm, taken from the reconstructed curves of distortion of the lenses. Figure 9 is the distortion compensation curve of the correction plate manufactured by Wild. The offset abscissa chosen for construction of the plates was used in order to reduce the thickness of glass. The shifted abscissa requires that the calibrated focal length of metrogon plates used with the correction plates must be increased by 0.066 mm. However the values, taken in reference to the original abscissa, can be used for comparison with curves of lenses whose calibrated focal length is set for zero distortion at $42\frac{1}{2}^{\circ}$.

After a comparison of the correction plate curve with the curves of distortion of the lenses, the amount of distortion which the correction plates would leave uncompensated was tabulated in Table VI. It is realized that 25 lenses is a small sampling of the number which has been manufactured. However, this is the entire

number submitted to the National Bureau of Standards, for testing, over a one year period, regardless of manufacturer or source. With this in mind, it is interesting to note that only two lenses (8%) have distortion curves sufficiently close to the correction plate curve, which is apparently a fairly widely accepted standard curve, to provide uncompensated errors less than ± 10 microns. Thirteen (62%) would have uncompensated errors less than ± 20 microns. Two (8%) of the lenses would have uncompensated errors in excess of 40 microns.

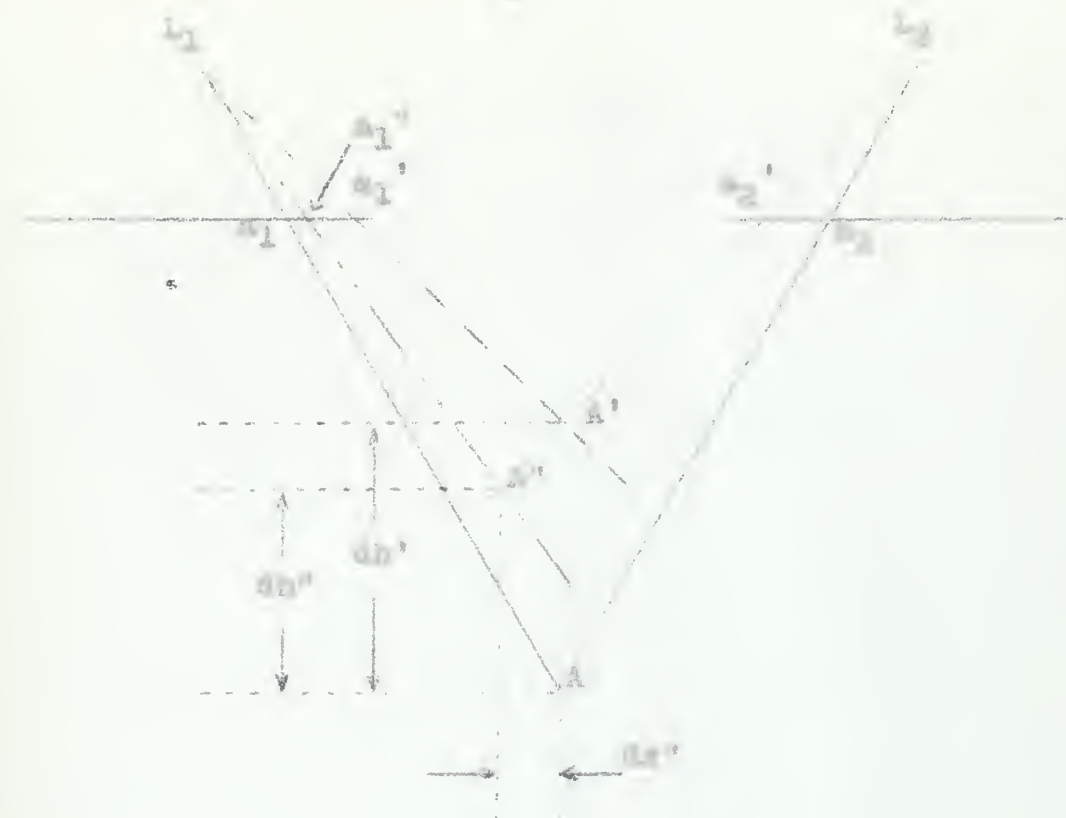
In order to determine the effect the above errors would have on a stereo model, an assumed elevation of 4,000 meters above terrain was chosen and elevation errors were computed using the basic relief displacement relationship, $d = rh \frac{p}{H}$ for computing an approximate elevation discrepancy which would result from the values in Table VI. This approximation is undoubtedly accurate enough for the number of significant digits used. These values, tabulated in Table VII, would not necessarily be the errors measured in a stereo model, as they would depend on the relative orientation achieved which in turn would depend upon the location of the chosen orientation points. This is true because, except along the line through the two principal points, the lens distortion will cause a varying amount of y-parallax. If this parallax is removed at the orientation points, the projected images will not have the true spatial relationship, and the effects of lens distortion at any given point in the model may be exaggerated or diminished

1. The first step in the process of identifying a problem is to determine the nature of the problem. This involves a thorough understanding of the situation and the people involved. It is important to gather as much information as possible about the problem, including its history, its current status, and the interests of the people involved. This information will be used to develop a clear and concise statement of the problem.

depending on the specific case. On the other hand, if the distortion at the chosen orientation points which are not on the line connecting the principal points happens to be zero from both projectors, the relative orientation will be true and the lens distortion will have full effect.

The values in Table VI will be the maximum possible elevation error at any given point, that is the larger of the two elevation errors at that point will be the maximum. This can be best demonstrated by diagramming the relationship of true and distorted rays at a point along the line connecting the principal points, as in Figure 1.

As can be seen from Figure 1, the maximum elevation error occurs when the elevation errors at a given point are equal which is true along the line equidistant from both principal points, and there will be an error in the X direction whenever the elevation errors are unequal. The same thing occurs at points which are not equidistant from both principal points or on lines through L_1 and L_2 parallel to this line, except that y-parallax is introduced. This can be seen in Figure 2. In Figure 2, point A" is not actually a point of intersection as the two rays pass through the vertical line through A-A' at different points. A" is the point on both lines at which there is no X or elevation separation and thus is the point which would be chosen in a stereo instrument as the true point with only y-parallax present. Actually, the ray from L_1 is in front of the ray from L_2 , as Figure 1 is drawn. The range of possible y positions in a stereo instrument would be between points



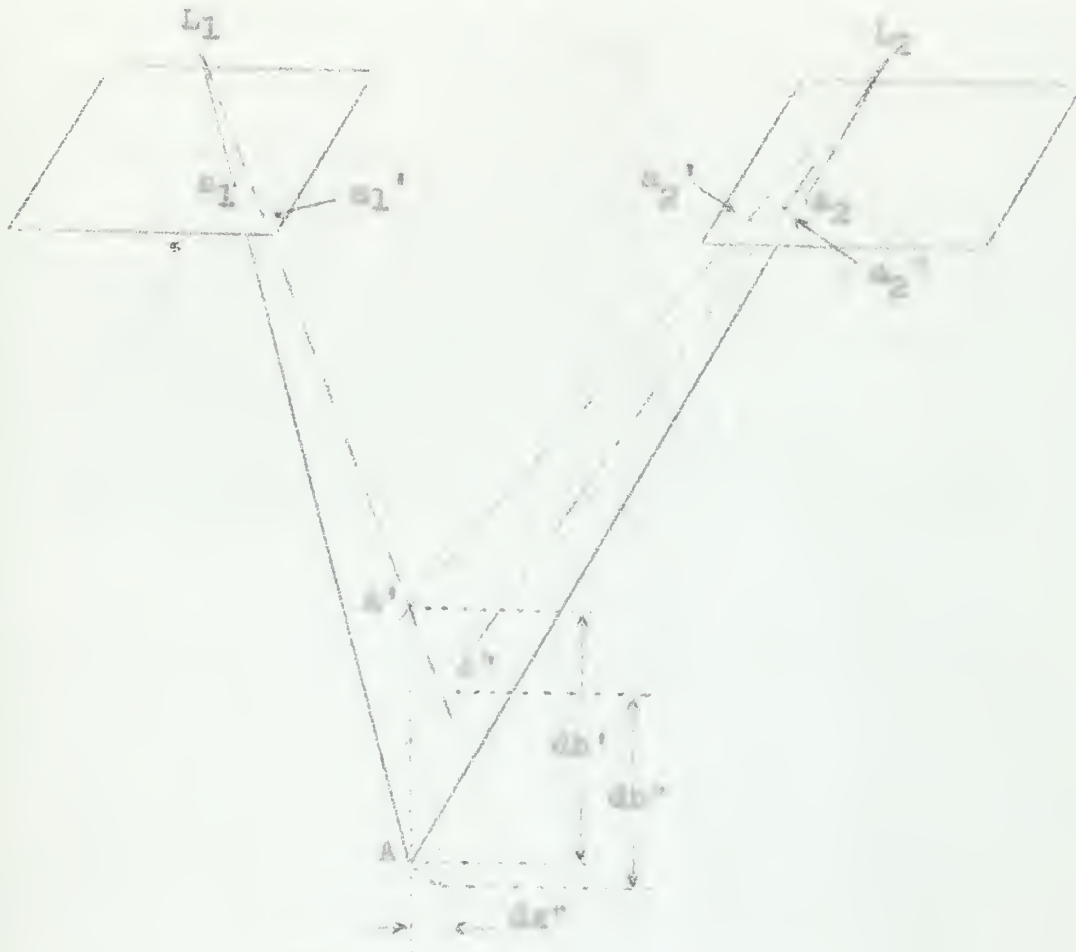
—————	True rays
- - - - -	Distorted rays of equal elevation error
_____	Distorted ray of unequal elevation error to ray from right projector
$a_1 a_2$	undistorted positions
$a_1' a_2'$	equally distorted positions
$a_1'' a_2'$	unequally distorted positions
A	true projected image
A'	projected image with equal distortions
A''	projected image with unequal distortions
dh'	elevation error with equal distortions
dh''	elevation error with unequal distortions
dx''	X error with unequal distortions

Figure 1

The first part of the report deals with the general
 situation of the country and the progress of the
 work. It is followed by a detailed account of the
 various expeditions and the results obtained. The
 second part of the report is devoted to the
 description of the various plants and animals
 which were discovered. It is followed by a
 list of the names of the various places visited
 and the names of the various people who
 were met. The third part of the report
 deals with the various diseases and
 accidents which occurred. It is followed by
 a list of the names of the various
 people who were killed and the names of
 the various places where they were killed.

List of names

The names of the various people who were met	1
The names of the various places visited	2
The names of the various diseases and accidents which occurred	3
The names of the various people who were killed	4
The names of the various places where they were killed	5
The names of the various plants and animals which were discovered	6
The names of the various diseases and accidents which occurred	7
The names of the various people who were killed	8
The names of the various places where they were killed	9
The names of the various plants and animals which were discovered	10



Symbols as used in Figure 1

Figure 2

A'' on rays from L_1 and L_2 . The exact position would depend on the relative orientation procedure. The point will be displaced by dx'' which will be zero in the event of equal elevation errors from both projectors, as at point A' .

There will be no X displacement of the image along a line equidistant from both principal points or lines through L_1 and L_2 parallel to this line as the points along the equidistant line will

There will be no displacement of the point A' and the
 position of the point A' will be determined by the position of the
 point A and the point B . The point A' will be located at the
 intersection of the line AB and the line AC . The point B' will be
 located at the intersection of the line AB and the line BC . The point
 C' will be located at the intersection of the line AC and the line BC .

Figure 1
 Diagram of the system



have equal distortion and thus equal elevation error at any given point along it, and the projection from either point parallel to the y -axis will have no X displacement.

As can be seen from Figures 1 and 2, the X displacement will always be toward the projector having the lowest (algebraically) elevation error at the point in question. The magnitude of the X displacement is computed as follows:

A drawing of a horizontal projection of the rays involved onto a plane containing both camera axes is constructed.

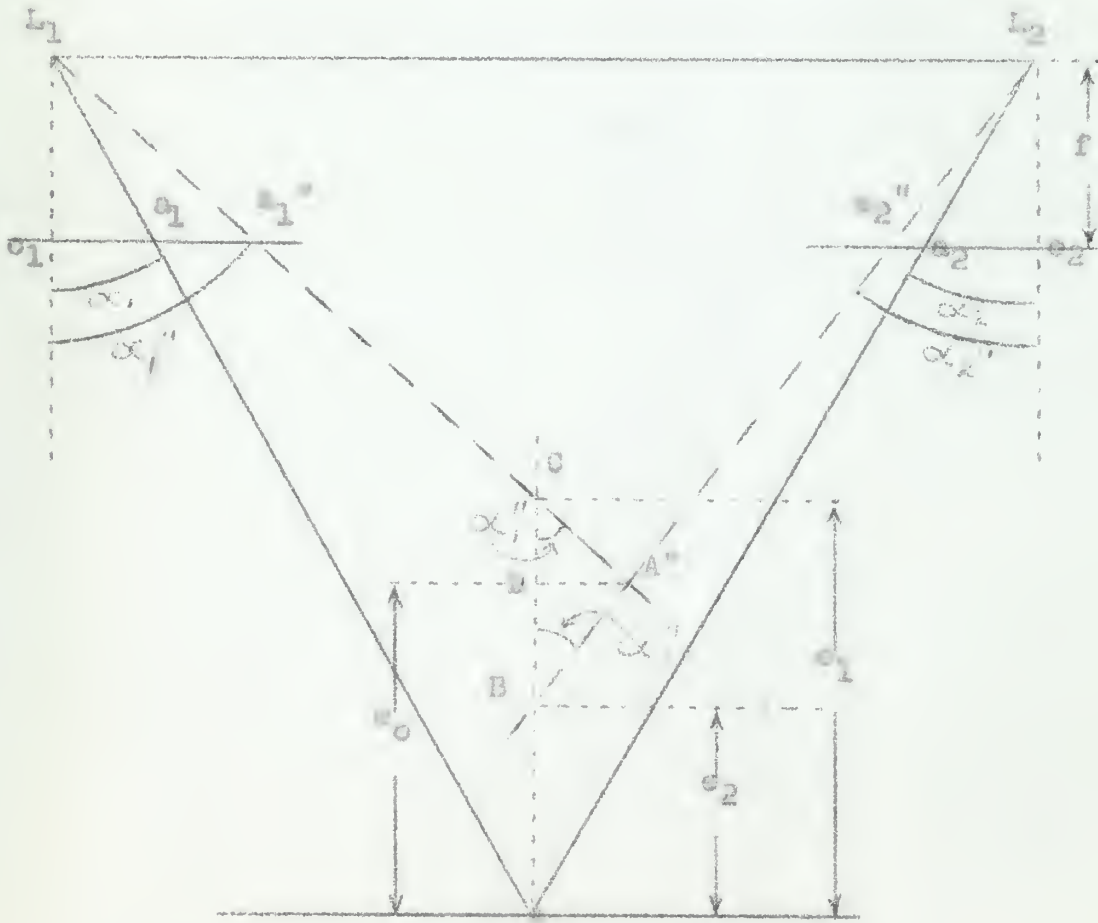


Figure 3

Let: $x_{a_1} = O_1 a_1''$ $x_{a_2} = O_2 a_2''$ $dX'' = DA''$

Then: $\tan \alpha_1'' = \frac{x_{a_1}}{f} = \frac{dX''}{CD}$ $\tan \alpha_2'' = \frac{x_{a_2}}{f} = \frac{dX''}{DB}$

$$dX'' = \frac{CD x_{a_1}}{f} = \frac{-BD x_{a_2}}{f} \text{ or } -BD = \frac{CD x_{a_1}}{x_{a_2}}$$

$$CD + BD = e_1 - e_2 \quad CD = e_1 - e_2 - BD$$

$$x_{a_1} (e_1 - e_2 - BD) = -BD x_{a_2} \quad BD (x_{a_1} - x_{a_2}) = x_{a_1} (e_1 - e_2)$$

$$BD = \frac{x_{a_1} (e_1 - e_2)}{x_{a_1} - x_{a_2}} \quad dX'' = \frac{-BD x_{a_2}}{f} = \frac{-x_{a_1} x_{a_2} (e_1 - e_2)}{f (x_{a_1} - x_{a_2})}$$

A plus sign in dX'' indicates displacement toward L_2 .

The range of possible y displacements can be shown by drawing a vertical view of the scheme displayed in Figure 3.

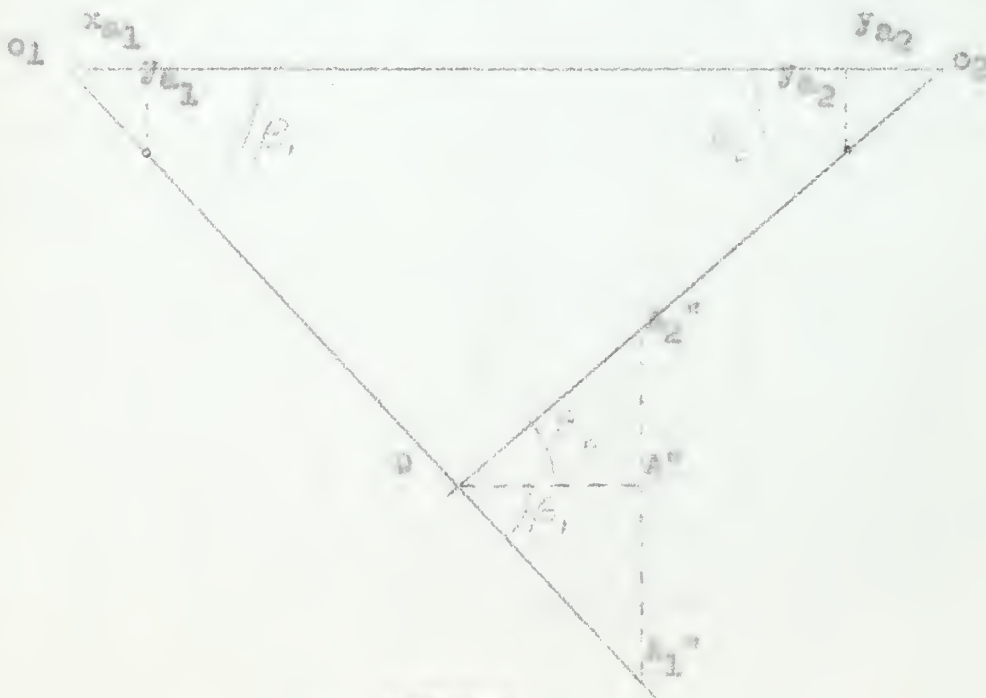


Figure 4

DA" = dX" (as shown in Figure 3)

$$A''A_2'' = dX'' \tan \beta_2 = \frac{y_{a_2} dX''}{-x_{a_2}} \quad A''A_1'' = dX'' \tan \beta_1 = \frac{y_{a_1} dX''}{x_{a_1}}$$

$$A''A_2'' = \frac{y_{a_2}}{-x_{a_2}} \left[\frac{-x_{a_1} x_{a_2} (e_1 - e_2)}{f(x_{a_1} - x_{a_2})} \right] = \frac{x_{a_1} y_{a_2} (e_1 - e_2)}{f(x_{a_1} - x_{a_2})}$$

$$A''A_1'' = \frac{y_{a_1}}{x_{a_1}} \left[\frac{-x_{a_1} x_{a_2} (e_1 - e_2)}{f(x_{a_1} - x_{a_2})} \right] = \frac{-x_{a_2} y_{a_1} (e_1 - e_2)}{f(x_{a_1} - x_{a_2})}$$

Thus:

$$\text{total parallax } A_1''A_2'' = \frac{x_{a_1} y_{a_2} (e_1 - e_2)}{f(x_{a_1} - x_{a_2})} - \frac{x_{a_2} y_{a_1} (e_1 - e_2)}{f(x_{a_1} - x_{a_2})}$$

$$A_1''A_2'' = \frac{(e_1 - e_2)(x_{a_1} y_{a_2} - x_{a_2} y_{a_1})}{f(x_{a_1} - x_{a_2})} \quad (\text{at ground scale})$$

$$\text{at photo scale } py = \frac{f}{H-h} A_1''A_2'' = \frac{(e_1 - e_2)(x_{a_1} y_{a_2} - x_{a_2} y_{a_1})}{(H-h)(x_{a_1} - x_{a_2})}$$

A plus sign in py indicates that A_2'' is in a positive Y direction from A_1'' .

An example using lens number 25 and assuming a 100 mm base length, with the point of detail 40 mm from station 1 and 60 mm from station 2 along the line between principal points, is presented. In the case of points not on this line, bear in mind that true radial distance from the principal point must be used to determine elevation error, and this distance will differ from the values of x_{a_1} and x_{a_2} .

Let $\alpha = \sqrt{2}$ and $\beta = \sqrt{3}$

$$\frac{1}{\alpha} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2} \quad \frac{1}{\beta} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

$$\frac{(\alpha + \beta)(\alpha\beta)}{\alpha\beta(\alpha + \beta)} = \left[\frac{(\alpha + \beta)(\alpha\beta)}{\alpha\beta(\alpha + \beta)} \right] \frac{1}{\alpha} = \frac{1}{\alpha}$$

$$\frac{(\alpha - \beta)(\alpha\beta)}{\alpha\beta(\alpha - \beta)} = \left[\frac{(\alpha - \beta)(\alpha\beta)}{\alpha\beta(\alpha - \beta)} \right] \frac{1}{\alpha} = \frac{1}{\alpha}$$

$$\frac{(\alpha + \beta)(\alpha\beta)}{\alpha\beta(\alpha + \beta)} = \frac{(\alpha - \beta)(\alpha\beta)}{\alpha\beta(\alpha - \beta)} = \frac{1}{\alpha}$$

$$\frac{(\alpha + \beta)(\alpha\beta) - (\alpha - \beta)(\alpha\beta)}{\alpha\beta(\alpha + \beta) - \alpha\beta(\alpha - \beta)} = \frac{1}{\alpha}$$

$$\frac{(\alpha + \beta)(\alpha\beta) - (\alpha - \beta)(\alpha\beta)}{\alpha\beta(\alpha + \beta) - \alpha\beta(\alpha - \beta)} = \frac{1}{\alpha}$$

Let $\alpha = \sqrt{2}$ and $\beta = \sqrt{3}$

Let $\alpha = \sqrt{2}$ and $\beta = \sqrt{3}$

Let $\alpha = \sqrt{2}$ and $\beta = \sqrt{3}$

$$x_{a_1} = 40 \text{ mm} \quad x_{a_2} = 60 \text{ mm} \quad e_1 = 1.3 \text{ m} \quad e_2 = 0.48 \text{ m}$$

$$f = 153.80 \text{ mm}$$

$$py = \frac{(1.3 - 0.48)(40 \pm 0 - 60 \pm 0)}{4000(40 - 60)} = 0 \text{ as the point is along the line between principal points.}$$

$$dx'' = \frac{(40)(60)(1.3 - 0.48)}{(153.80)(40 + 60)} = 0.128 \text{ m at natural scale.}$$

The magnitude of the resultant elevation error can also be computed using Figure 3 as a reference.

$$AD = e_o \text{ (resultant elevation error)} = AB + BD$$

$$AB = e_2 \quad BD = dx'' \cot \alpha_2''$$

$$\cot \alpha_2'' = f / -x_{a_2}$$

$$BD = \frac{f dx''}{-x_{a_2}}$$

$$\text{Thus: } e_o = e_2 - \frac{f dx''}{x_{a_2}}$$

Using the example of lens number 25:

$$e_o = 0.48 - \frac{153.80 \times 0.128}{-60} = 0.81 \text{ m}$$

The signs of x_{a_1} , x_{a_2} , y_{a_1} , y_{a_2} are as measured in a photo scale model (positive print) for the above derivations. The above computational procedures are applicable to all types of photography once the curve of elevation errors due to distortion has been determined. Thus the elevation error and the X displacement caused by lens distortion can be computed for any given point in the stereo model. This condition, of course, will only be the true situation

$$a(0,0) = \frac{1}{2} \quad a(1,1) = \frac{1}{2} \quad a(0,1) = \frac{1}{2} \quad a(1,0) = \frac{1}{2}$$

$$a(0,0) = \frac{1}{2}$$

$$a(1,1) = \frac{1}{2} \quad a(0,1) = \frac{1}{2} \quad a(1,0) = \frac{1}{2}$$

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$$a(1,0) = \frac{1}{2}$$

$$a(0,0) = \frac{1}{2}$$

$$a(1,1) = \frac{1}{2}$$

if the relative orientation has been completed so that a true spatial model has been developed.

In the above example, presume that the elevation variation of the terrain is 10% of the flying height above the terrain. Because the values of e_1 and e_2 are directly proportional to the flying heights, and e_o and dx'' are directly proportional to first order equations containing e_1 and e_2 , the values will vary 10% of the computed value, thus:

<u>Qty</u>	<u>Computed Value</u>	<u>10% Variation</u>
e_o	0.81 m	0.73 to 0.89 m
dx''	0.128 m	0.115 to 0.141 m

Therefore the accuracy of elevation computation would be one part in 50,000 of the flying height, and the accuracy of the X coordinate would be one part in 300,000 of the flying height.

and a full 100 per cent of the total amount of the

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TABLE I

FOCAL LENGTHS

Lens No.	Equivalent	Calibrated
	Focal Length	Focal Length
	mm	mm
1	152.67	152.77
2	153.39	153.45
3	154.31	154.31
4	153.86	153.85
5	151.85	151.90
6	154.34	154.37
7	151.70	151.70
8	152.94	152.95
9	154.34	154.34
10	153.19	153.22
11	153.33	153.30
12	153.73	153.70
13	153.67	153.75
14	152.58	152.62
15	153.19	153.20
16	153.36	153.30
17	152.79	152.76
18	153.72	153.68
19	153.81	153.80
20	155.37	155.35
21	153.98	153.89
22	153.40	153.36
23	154.22	154.19
24	152.54	152.49
25	153.90	153.80
Ave.		153.44

The probable errors of these determinations of focal length do not exceed ± 0.10 mm.

TABLE 1

FISH CATCHES

Year	Total catch	Per cent of total
1900	10,000	100
1901	11,000	110
1902	12,000	120
1903	13,000	130
1904	14,000	140
1905	15,000	150
1906	16,000	160
1907	17,000	170
1908	18,000	180
1909	19,000	190
1910	20,000	200
1911	21,000	210
1912	22,000	220
1913	23,000	230
1914	24,000	240
1915	25,000	250
1916	26,000	260
1917	27,000	270
1918	28,000	280
1919	29,000	290
1920	30,000	300
1921	31,000	310
1922	32,000	320
1923	33,000	330
1924	34,000	340
1925	35,000	350
1926	36,000	360
1927	37,000	370
1928	38,000	380
1929	39,000	390
1930	40,000	400
1931	41,000	410
1932	42,000	420
1933	43,000	430
1934	44,000	440
1935	45,000	450
1936	46,000	460
1937	47,000	470
1938	48,000	480
1939	49,000	490
1940	50,000	500
1941	51,000	510
1942	52,000	520
1943	53,000	530
1944	54,000	540
1945	55,000	550
1946	56,000	560
1947	57,000	570
1948	58,000	580
1949	59,000	590
1950	60,000	600
1951	61,000	610
1952	62,000	620
1953	63,000	630
1954	64,000	640
1955	65,000	650
1956	66,000	660
1957	67,000	670
1958	68,000	680
1959	69,000	690
1960	70,000	700
1961	71,000	710
1962	72,000	720
1963	73,000	730
1964	74,000	740
1965	75,000	750
1966	76,000	760
1967	77,000	770
1968	78,000	780
1969	79,000	790
1970	80,000	800
1971	81,000	810
1972	82,000	820
1973	83,000	830
1974	84,000	840
1975	85,000	850
1976	86,000	860
1977	87,000	870
1978	88,000	880
1979	89,000	890
1980	90,000	900
1981	91,000	910
1982	92,000	920
1983	93,000	930
1984	94,000	940
1985	95,000	950
1986	96,000	960
1987	97,000	970
1988	98,000	980
1989	99,000	990
1990	100,000	1000

The figures shown in this table are for the year 1900.

The figures shown in this table are for the year 1900.

TABLE II

DISTORTION REFERRED TO THE EQUIVALENT FOCAL LENGTH IN MICRONS

Lens No.	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
1	0	-2	1	13	38	76	126	173	172	9
2	0	-2	2	12	31	65	119	164	142	-74
3	0	-1	1	10	30	60	96	119	81	-120
4	0	-2	1	12	31	62	92	108	62	-128
5	0	-2	2	16	34	70	107	140	113	-63
6	0	-2	2	13	22	64	96	132	110	-80
7	0	-2	2	12	34	65	96	115	70	-120
8	0	-2	2	14	34	64	100	130	100	-104
9	0	0	0	11	32	61	99	123	96	-120
10	0	-2	2	13	30	71	114	146	120	-92
11	0	-2	2	6	33	73	112	146	116	-89
12	0	-3	2	10	30	60	92	110	62	-150
13	0	-3	2	9	28	61	103	158	172	-10
14	0	-2	1	14	36	72	109	140	115	-82
15	0	-2	2	13	33	67	100	119	89	-97
16	0	-1	0	10	28	50	74	86	34	-184
17	0	0	0	10	30	56	87	102	56	-153
18	0	-1	1	11	26	52	77	95	35	-163
19	0	-1	1	13	30	58	94	121	83	-135
20	0	-1	-2	10	28	57	97	119	77	-154
21	0	-3	2	12	28	49	74	77	11	-227
22	0	-4	3	10	29	52	80	94	49	-161
23	0	-2	2	12	34	63	94	110	62	-148
24	0	-1	1	8	36	66	88	94	40	-174
25	0	0	0	8	19	42	60	61	-1	-220
Average	0	-2	1	11	31	62	95	119	63	-122

[illegible]

TABLE III

DISTORTION REFERRED TO THE CALIBRATED FOCAL LENGTH IN MICRONS

Lens No.	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
1	0	-11	-18	-15	0	27	65	98	84	-98
2	0	-6	-7	-2	12	44	89	127	98	-127
3	0	-1	1	10	30	60	96	119	81	-120
4	0	-1	3	15	35	67	98	116	71	-116
5	0	-6	-6	4	18	49	81	108	75	-108
6	0	-5	-3	5	11	50	79	111	85	-110
7	0	-2	3	13	36	67	99	116	74	-116
8	0	-3	-1	10	29	57	91	120	87	-119
9	0	0	0	11	32	61	99	123	96	-120
10	0	-5	-3	5	19	56	96	124	94	-124
11	0	-5	-4	-2	21	58	93	123	88	-123
12	0	-1	6	16	38	71	105	126	82	-126
13	0	-10	-13	-14	-3	21	53	97	100	-97
14	0	-5	-4	5	23	57	90	116	87	-116
15	0	-3	0	10	29	61	93	110	79	-110
16	0	4	10	25	49	77	107	126	82	-126
17	0	3	5	18	41	70	104	123	81	-123
18	0	3	8	22	41	71	100	123	69	-123
19	0	0	3	15	33	62	99	128	89	-127
20	0	1	2	15	35	66	109	133	94	-134
21	0	4	17	35	59	89	123	137	82	-139
22	0	0	10	21	44	71	103	122	83	-122
23	0	0	6	18	42	73	107	125	80	-125
24	0	3	9	20	52	87	114	125	79	-125
25	0	8	16	32	52	85	114	126	79	-126
Average	0	-2	2	12	31	62	96	120	84	-120

The values of the distortion are measured in microns and indicate the displacement of the image from its distortion-free position. A positive value indicates a displacement from the center of the plate. The probable error does not exceed ± 10 microns.

TABLE IV
RADIAL DISTANCES BASED ON FOCAL LENGTHS IN MM

Lens	2°	5°	10°	15°	20°	25°	30°	35°	40°	42.5°
1	152.77	13.37	25.94	40.93	55.60	71.24	86.20	106.97	126.19	139.99
2	153.45	13.43	27.06	41.12	55.85	71.55	86.59	107.45	126.76	140.61
3	154.31	13.50	27.21	41.35	56.16	71.96	89.09	108.05	129.46	141.40
4	153.85	13.46	27.13	41.22	56.00	71.74	86.83	107.73	129.10	140.98
5	151.90	13.29	26.78	40.70	55.29	70.83	87.70	106.36	127.46	139.19
6	154.37	13.51	27.22	41.36	56.19	71.98	89.13	108.09	129.53	141.45
7	151.70	13.27	26.75	40.65	55.21	70.74	87.58	106.22	127.29	139.01
8	152.95	13.38	26.97	40.90	55.67	71.32	86.31	107.10	126.34	140.15
9	154.34	13.50	27.21	41.36	56.18	71.97	89.11	108.07	129.51	141.43
10	153.22	13.41	27.02	41.06	55.77	71.45	88.46	107.29	128.57	140.40
11	153.30	13.41	27.03	41.06	55.80	71.49	88.51	107.34	128.63	140.47
12	153.79	13.45	27.10	41.18	55.94	71.67	88.74	107.62	128.97	140.84
13	153.75	13.45	27.11	41.20	55.96	71.69	88.77	107.66	129.01	140.89
14	152.62	13.35	26.91	40.99	55.55	71.17	88.12	106.87	126.66	139.65
15	153.20	13.40	27.01	41.05	55.76	71.44	88.45	107.27	128.59	140.39
16	153.30	13.41	27.03	41.06	55.80	71.49	88.51	107.34	128.63	140.47
17	152.76	13.36	26.94	40.93	55.60	71.23	86.20	106.96	128.16	139.96
18	153.68	13.45	27.10	41.16	55.93	71.66	88.73	107.61	128.95	140.82
19	153.80	13.46	27.12	41.21	55.98	71.72	88.80	107.69	129.05	140.93
20	155.35	13.59	27.39	41.63	56.54	72.44	89.69	108.78	130.35	142.35
21	153.89	13.46	27.13	41.23	56.01	71.76	88.85	107.76	129.13	141.01
22	153.36	13.42	27.04	41.09	55.82	71.51	88.54	107.36	128.68	140.53
23	154.19	13.49	27.19	41.32	56.12	71.90	89.02	107.97	129.38	141.29
24	152.49	13.34	26.89	40.86	55.50	71.11	88.04	106.77	127.95	139.73
25	153.80	13.46	27.12	41.21	55.96	71.72	88.80	107.69	129.05	140.93
Ave.	153.44	13.43	27.06	41.12	55.85	71.55	88.56	107.45	128.75	140.60

第 一	第 一 次 考 試 之 成 績 如 下	100
第 二	第 二 次 考 試 之 成 績 如 下	100
第 三	第 三 次 考 試 之 成 績 如 下	100
第 四	第 四 次 考 試 之 成 績 如 下	100
第 五	第 五 次 考 試 之 成 績 如 下	100
第 六	第 六 次 考 試 之 成 績 如 下	100
第 七	第 七 次 考 試 之 成 績 如 下	100
第 八	第 八 次 考 試 之 成 績 如 下	100
第 九	第 九 次 考 試 之 成 績 如 下	100
第 十	第 十 次 考 試 之 成 績 如 下	100
第 十 一	第 十 一 次 考 試 之 成 績 如 下	100
第 十 二	第 十 二 次 考 試 之 成 績 如 下	100
第 十 三	第 十 三 次 考 試 之 成 績 如 下	100
第 十 四	第 十 四 次 考 試 之 成 績 如 下	100
第 十 五	第 十 五 次 考 試 之 成 績 如 下	100
第 十 六	第 十 六 次 考 試 之 成 績 如 下	100
第 十 七	第 十 七 次 考 試 之 成 績 如 下	100
第 十 八	第 十 八 次 考 試 之 成 績 如 下	100
第 十 九	第 十 九 次 考 試 之 成 績 如 下	100
第 二 十	第 二 十 次 考 試 之 成 績 如 下	100

TABLE V
TABLE OF LENS DISTORTIONS IN MICRONS TAKEN FROM RECONSTRUCTED CURVES

Lens	20 mm	40 mm	60 mm	80 mm	100 mm	120 mm	140 mm	150 mm
1	-14.4	-15.5	+ 6.0	+ 46.0	+ 89.2	+100.0	0	- 77.0
2	- 6.8	- 2.8	+16.2	+ 66.3	+117.1	+120.7	+ 5.0	- 93.3
3	- 0.4	+ 8.6	+36.5	+ 70.2	+112.2	+109.8	+13.2	- 78.6
4	+ 0.1	+13.7	+42.0	+ 83.1	+113.6	+101.0	+ 3.0	- 84.0
5	- 6.8	+ 3.7	+25.9	+ 66.7	+103.0	+ 94.6	- 7.0	- 93.0
6	- 4.7	+ 4.1	+15.0	+ 66.0	+102.0	+105.0	+13.0	- 72.0
7	- 0.2	+12.6	+46.0	+ 85.0	+113.2	+102.3	- 9.6	-100.0
8	- 3.0	+ 8.4	+36.6	+ 73.4	+114.5	+110.6	+ 3.5	- 91.2
9	0	+ 9.0	+38.4	+ 78.0	+118.0	+117.8	+13.0	- 80.0
10	- 4.8	+ 4.1	+28.5	+ 76.4	+118.3	+116.0	+ 4.0	- 92.0
11	- 4.8	- 2.2	+30.7	+ 76.5	+114.0	+113.0	+ 4.3	- 91.0
12	+ 1.5	+14.8	+46.4	+ 87.5	+122.2	+114.5	+ 7.0	- 93.0
13	-12.2	-14.3	+ 1.8	+ 36.4	+ 77.5	+117.3	- 6.7	- 89.0
14	- 5.2	+ 3.8	+31.2	+ 74.5	+110.0	+107.5	- 2.3	- 93.0
15	- 2.8	+ 9.3	+36.2	+ 78.0	+107.0	+100.4	+ 3.0	- 81.7
16	+ 5.7	+23.3	+54.5	+ 92.8	+122.2	+112.5	+ 3.3	- 92.3
17	+ 3.0	+16.6	+49.5	+ 86.0	+120.0	+110.4	- 0.5	- 96.2
18	+ 4.8	+20.3	+48.0	+ 86.0	+116.0	+101.0	+ 4.8	- 85.0
19	+ 0.4	+13.3	+40.9	+ 79.4	+122.5	+119.0	+ 8.0	- 90.0
20	0	+12.9	+41.0	+ 83.0	+128.0	+125.0	+24.0	- 79.0
21	+ 9.7	+33.0	+66.2	+106.3	+135.4	+122.0	+ 8.0	- 96.0
22	+ 4.2	+19.7	+51.0	+ 86.4	+118.2	+111.3	+ 4.0	- 82.3
23	+ 2.0	+16.5	+48.8	+ 89.5	+121.5	+113.5	+11.0	- 83.2
24	+ 5.6	+19.0	+64.0	+102.2	+125.3	+105.0	- 3.0	-100.0
25	+11.9	+30.0	+58.2	+101.5	+123.8	+111.5	+ 6.7	- 89.5
Ave.	- 0.7	+11.2	+39.0	+ 79.0	+115.6	+109.0	+ 5.8	- 88.0

TABLE VI
TABLE OF DISTORTION, IN MICRONS, REMAINING UNCOMPENSATED BY PLATES

Lens	20 mm	40 mm	60 mm	80 mm	100 mm	120 mm	140 mm	150 mm
1	-16.4	-32.5	-45.0	-44.0	-26.8	-1.0	-10.0	-1.0
2	-8.8	-19.8	-34.8	-23.7	+1.1	+19.7	-5.0	-17.0
3	-2.4	-8.4	-14.5	-11.8	-3.8	+8.8	+3.2	-2.8
4	-1.9	-3.3	-9.0	-6.9	-2.4	0	-7.0	-8.0
5	-8.8	-13.3	-25.1	-23.3	-13.0	-6.4	-17.0	-17.0
6	-6.7	-12.9	-36.0	-24.0	-14.0	+4.0	+3.0	+4.0
7	-2.2	-4.4	-5.0	-5.0	-2.8	+1.3	-19.6	-24.0
8	-5.0	-8.6	-14.4	-16.6	-1.5	+9.6	-6.5	-15.2
9	-2.0	-8.0	-12.6	-12.0	+2.0	+16.8	+3.0	-4.0
10	-6.8	-12.9	-22.5	-13.6	+2.3	+15.0	-6.0	-16.0
11	-6.8	-19.2	-20.3	-13.5	-2.0	+12.0	-5.7	-15.0
12	-0.5	-2.2	-4.6	-2.5	+6.2	+13.5	-3.0	-17.0
13	-14.2	-31.3	-49.2	-53.6	-38.5	+16.3	-3.3	+7.0
14	-7.2	-13.2	-19.8	-15.5	-6.0	+6.5	-12.3	-17.0
15	-4.8	-6.7	-14.8	-12.0	-9.0	-0.6	-7.0	-5.7
16	+3.7	+6.3	+3.5	+2.8	+6.2	+11.5	-6.7	-16.3
17	+1.0	-0.4	-1.5	-4.0	+4.0	+9.4	-10.5	-22.2
18	+2.8	+3.3	-3.0	-4.0	0	0	-5.2	-9.0
19	-1.6	-3.7	-10.1	-10.6	+6.5	+18.0	-2.0	-14.0
20	-2.0	-4.1	-10.0	-7.0	+12.0	+24.0	+14.0	-3.0
21	+7.7	+16.0	+15.2	+16.3	+19.4	+21.0	-2.0	-22.0
22	+2.2	+2.7	0	-3.6	+2.2	+10.3	-6.0	-6.3
23	0	-0.5	-2.2	-0.5	+5.5	+12.5	+1.0	-7.2
24	+3.6	+2.0	+13.0	+12.2	+9.3	+4.0	-13.0	-24.0
25	+9.9	+13.0	+7.2	+11.5	+7.8	+10.5	-3.3	-13.5
Ave.	-2.7	-5.6	-12.0	-11.0	-0.4	+8.0	-4.2	-12.0

TABLE VII
TABLE OF ELEVATION ERRORS IN METERS

Lens	20 mm	40 mm	60 mm	80 mm	100 mm	120 mm	140 mm	150 mm
1	-3.28	-3.25	-3.00	-2.20	-1.07	-0.03	-0.29	-0.03
2	-1.76	-1.98	-2.32	-1.18	+0.04	+0.66	-0.14	-0.45
3	-0.48	-0.84	-0.97	-0.59	-0.15	+0.29	+0.09	-0.07
4	-0.38	-0.33	-0.60	-0.35	-0.10	0	-0.20	-0.21
5	-1.76	-1.33	-1.67	-1.16	-0.52	-0.21	-0.49	-0.45
6	-1.34	-1.29	-2.40	-1.20	-0.56	+0.13	+0.09	+0.11
7	-0.44	-0.44	-0.33	-0.25	-0.11	+0.04	-0.56	-0.64
8	-1.00	-0.86	-0.96	-0.83	-0.06	+0.32	-0.19	-0.41
9	-0.40	-0.80	-0.84	-0.60	+0.08	+0.56	+0.09	-0.11
10	-1.36	-1.29	-1.50	-0.68	-0.09	+0.50	-0.17	-0.43
11	-1.36	-1.92	-1.35	-0.68	-0.06	+0.40	-0.16	-0.40
12	-0.10	-0.22	-0.31	-0.12	-0.25	+0.45	-0.09	-0.45
13	-2.84	-3.13	-3.28	-2.68	-1.54	+0.55	-0.09	+0.19
14	-1.44	-1.32	-1.32	-0.78	-0.24	+0.22	-0.35	-0.45
15	-0.96	-0.67	-0.98	-0.60	-0.36	-0.02	-0.20	-0.15
16	+0.74	+0.63	+0.23	+0.14	+0.25	+0.35	-0.19	-0.43
17	+0.20	-0.04	-0.10	-0.20	+0.16	+0.31	-0.30	-0.59
18	+0.56	+0.33	-0.20	-0.20	0	0	-0.15	-0.24
19	-0.32	-0.37	-0.67	-0.53	+0.26	+0.60	-0.06	-0.37
20	-0.40	-0.41	-0.67	-0.35	+0.48	+0.80	+0.40	-0.06
21	+1.54	+1.60	-1.01	+0.82	+0.78	+0.70	-0.06	-0.59
22	+0.44	+0.27	0	-0.18	+0.09	+0.34	-0.17	-0.17
23	0	-0.05	-0.14	-0.03	+0.22	+0.42	+0.03	-0.19
24	+0.72	+0.20	+0.87	+0.61	+0.38	+0.13	-0.37	-0.64
25	+1.98	+1.30	+0.48	+0.58	+0.31	+0.35	-0.09	-0.36
Ave.	-0.54	-0.58	-0.80	-0.55	-0.02	+0.27	-0.12	-0.32

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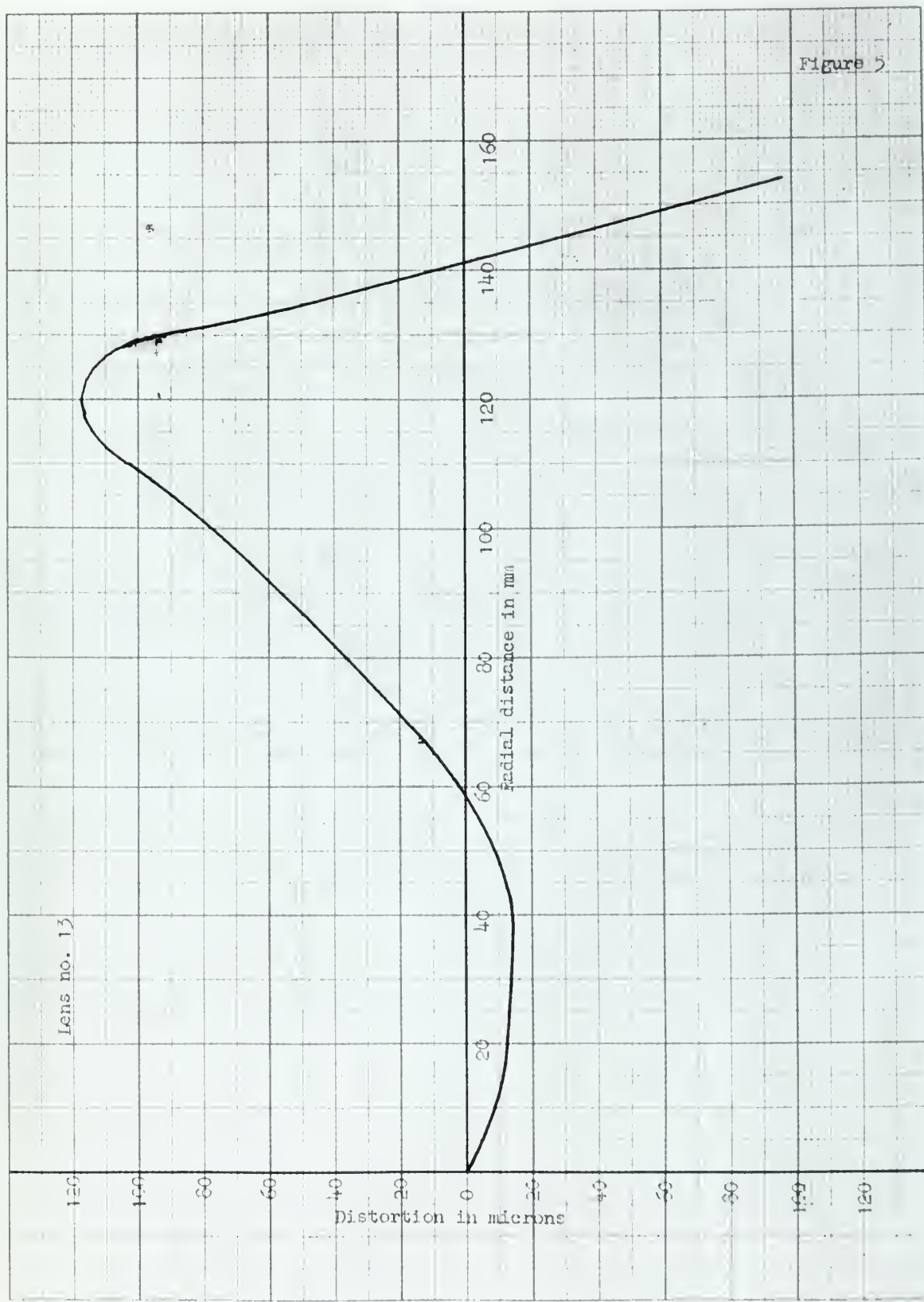


Figure 7

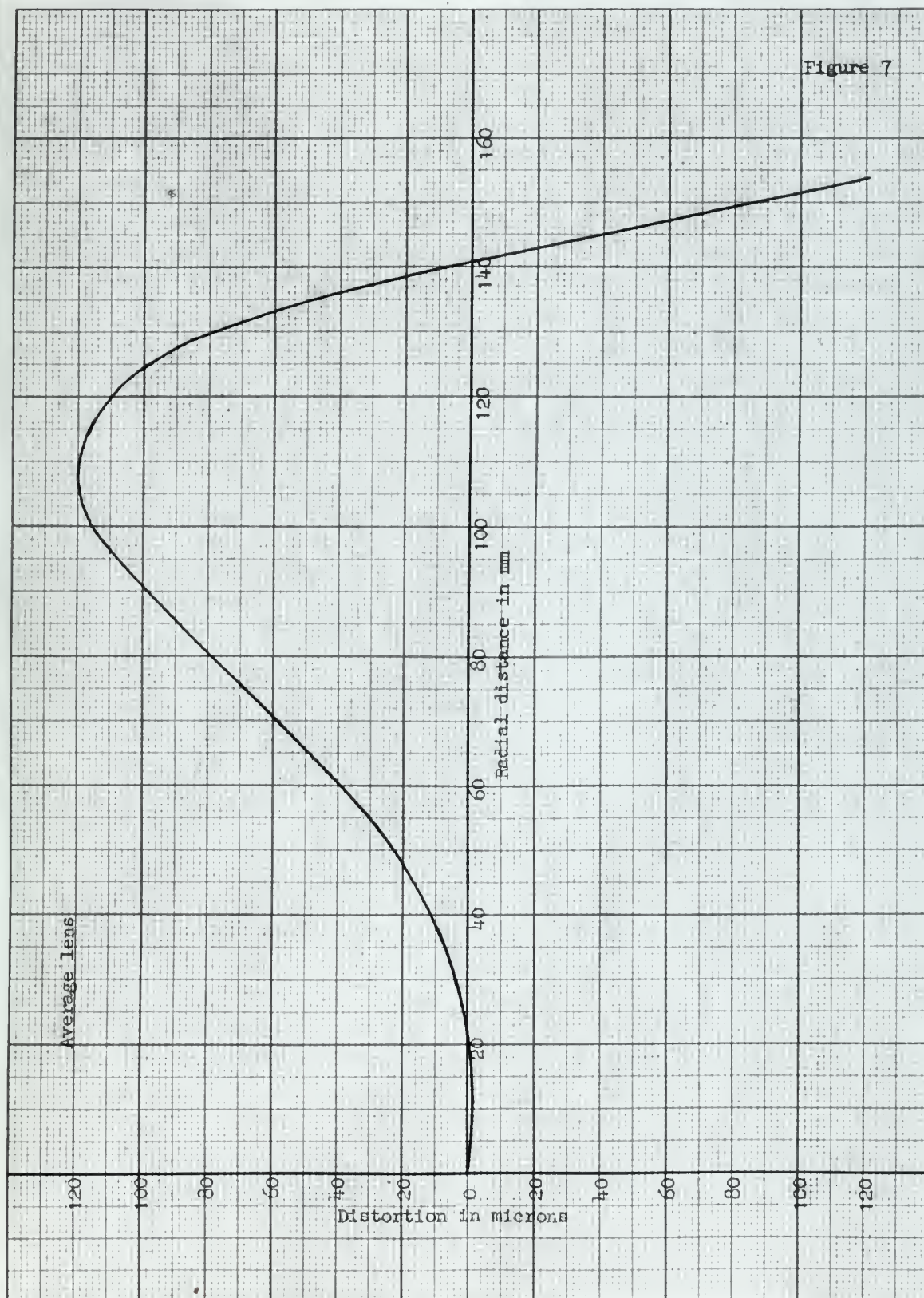
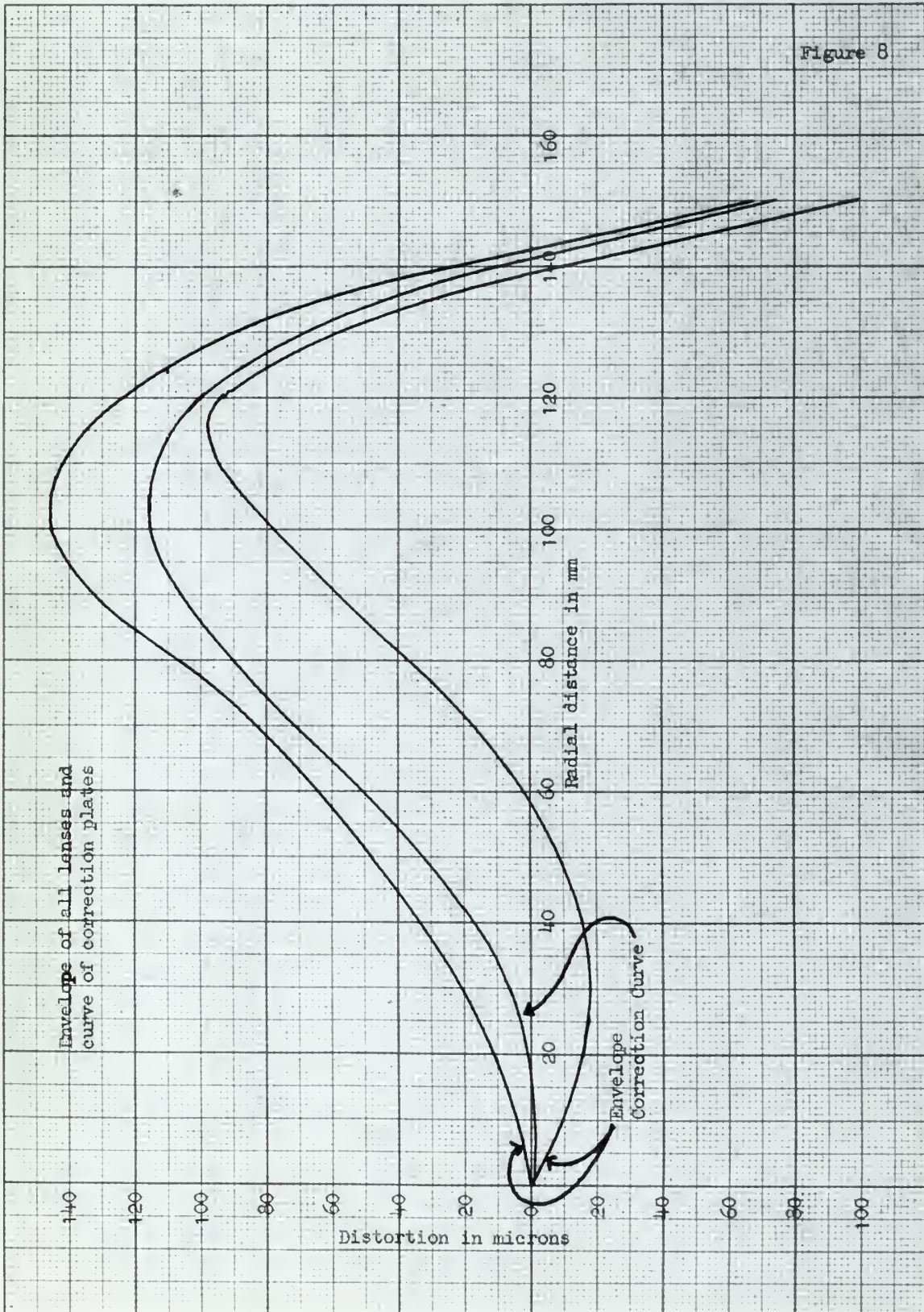
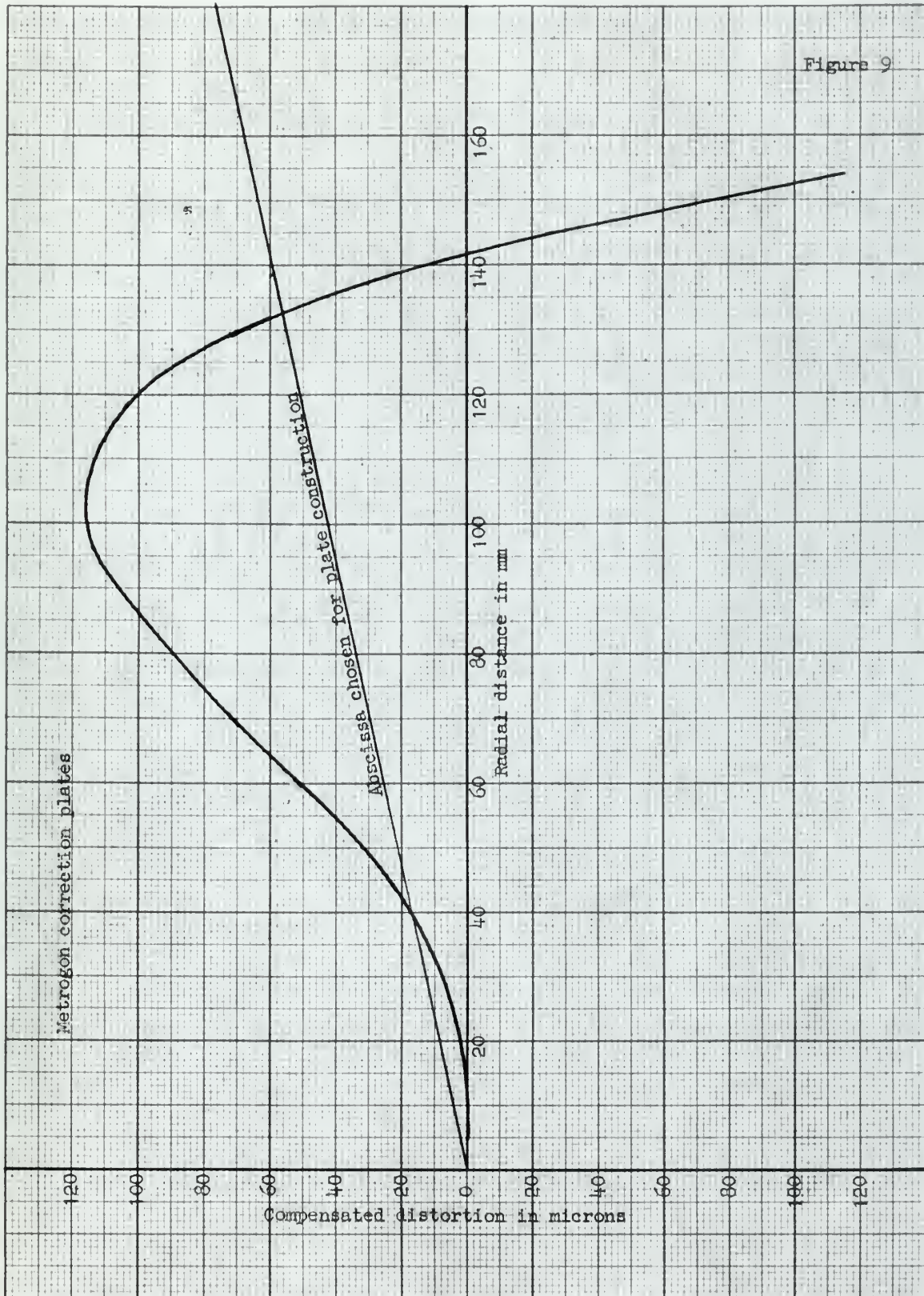


Figure 8





VERIFYING THE CURVE OF THE NITROGEN CORRECTION PLATES

The nitrogen correction plates, serials 49 and 50, which were manufactured for The Ohio State University by Wild Instruments were used with grid test plates 377 and 378 to determine the actual displacement caused by the correction plates. These observations were made in the Wild A7 Autograph, using monocular vision and observing each grid plate through each correction plate. The instrument adjustments were all zeroed except focal length, set at 125 mm, and z, set at 300 mm. The measurements are contained in Tables VIII through XI. The numbering system used is consistent for all measurements. The first number refers to rows parallel to the X axis, starting on the Y positive (upper) side of the plate. The second number refers to rows parallel to the Y axis, starting at the X negative (left) side of the plate. The average distance of the projection of each grid intersection from the center is tabulated in Tables XII through XV.

These measurements were then compared with the true positions of the grid intersections. The distortions were then graphically converted to radial and tangential distortion and tabulated in Tables XVI through XIX. Then the distortion figures were reduced to photo scale, averaged for each correction plate and tabulated in Tables XX and XXI. The sign conventions used in Table XVI and subsequently are positive away from center in the case of radial, and

THEORY OF THE ELECTRIC CIRCUIT

The electric circuit theory is based on the assumption that the electric field is conservative. This means that the line integral of the electric field around any closed path is zero. This is equivalent to saying that the curl of the electric field is zero. The electric field is then determined by the scalar potential function, which satisfies Laplace's equation in regions where there are no charges. In regions where there are charges, Poisson's equation must be solved. The electric field is then used to determine the current density, which is given by Ohm's law. The current density is then used to determine the magnetic field, which is given by the Biot-Savart law. The magnetic field is then used to determine the induced electric field, which is given by Faraday's law. This process continues until all the fields are determined. The theory of the electric circuit is then used to analyze the behavior of electrical circuits.

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positive clockwise when viewed from above in the case of tangential distortion.

As is obvious from the tangential distortion figures, there is apparently some θ rotation error in the alignment of the grid plates in the autograph. In order to eliminate any effect of this error, the summation of the tangential distortions divided by the radial distance from center was set equal to zero and corrections applied accordingly. The results of these computations appear in Tables XXII and XXIII. Plots of these values do not indicate any systematic error except that the lower left half (as viewed from the top) is predominately negative and the upper right half is predominately positive. The magnitudes of distortion within these areas are completely random. The positive and negative patterns being similar indicates a systematic error either in the autograph optics or in the manufacture of the correction plates. There is not sufficient information or specialized equipment available to this writer to determine which source caused the error.

The radial distortions contained in Tables XX and XXI are plotted in relation to the curve provided Wild for the manufacture of the correction plates in Figures 10 and 11. As can be seen, the same range of random errors is present in radial distortion as is present in tangential distortion. However, the radial figures indicate a displacement toward the lower right of approximately the same magnitude as is evidenced by the tangential distortion.

If the above displacement were compensated, the tangential distortion figures would show no definite pattern and the radial

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Differences in the resulting effectiveness of these factors amongst individuals

distortion would approximate, within ± 10 microns, the curve provided for the construction of the plates. The errors resulting can be disregarded in any computation, without resulting in any appreciable error.

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At the time of the study, the following information was available:

TABLE VIII

GRID 377 PLATE 49, GRID INTERSECTION COORDINATES

Point	X	Y	Point	X	Y
1-1	5627.53	1071.21	2-1	5627.42	1023.10
	53	22		42	11
	52	22		42	10
	53	21		42	10
2	5579.43	1071.09	2	5579.39	1023.03
	44	09		39	03
	44	10		39	03
	43	11		39	03
3	5531.41	1071.02	3	5531.39	1023.00
	40	02		39	01
	40	01		39	00
	41	03		39	01
4	5483.41	1070.99	4	5483.43	1023.00
	41	98		43	00
	41	99		43	01
	42	00		43	22.99
5	5435.46	1070.99	5	5435.49	1023.01
	46	99		50	01
	45	98		49	01
	46	98		49	01
6	5387.50	1070.98	6	5387.52	1023.03
	49	99		52	03
	49	99		52	03
	50	99		52	03
7	5339.54	1070.99	7	5339.55	1023.03
	54	99		55	03
	53	99		55	03
	53	98		55	02
8	5291.57	1071.01	8	5291.60	1023.02
	57	01		60	03
	57	70.99		60	02
	57	99		59	01
9	5243.58	1071.03	9	5243.63	1023.02
	59	04		64	02
	59	03		64	02
	60	03		63	02
10	5195.55	1071.11	10	5195.65	1023.07
	56	12		64	07
	57	11		64	06
	56	11		64	06
11	5147.42	1071.24	11	5147.56	1023.14
	42	23		57	13
	42	25		56	13
	42	25		56	13

TABLE 1

Summary of the results of the analysis of variance for the different groups of subjects

Group	1	2	3	4	5
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000
3	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
12	1.0000	1.0000	1.0000	1.0000	1.0000
13	1.0000	1.0000	1.0000	1.0000	1.0000
14	1.0000	1.0000	1.0000	1.0000	1.0000
15	1.0000	1.0000	1.0000	1.0000	1.0000
16	1.0000	1.0000	1.0000	1.0000	1.0000
17	1.0000	1.0000	1.0000	1.0000	1.0000
18	1.0000	1.0000	1.0000	1.0000	1.0000
19	1.0000	1.0000	1.0000	1.0000	1.0000
20	1.0000	1.0000	1.0000	1.0000	1.0000
21	1.0000	1.0000	1.0000	1.0000	1.0000
22	1.0000	1.0000	1.0000	1.0000	1.0000
23	1.0000	1.0000	1.0000	1.0000	1.0000
24	1.0000	1.0000	1.0000	1.0000	1.0000
25	1.0000	1.0000	1.0000	1.0000	1.0000
26	1.0000	1.0000	1.0000	1.0000	1.0000
27	1.0000	1.0000	1.0000	1.0000	1.0000
28	1.0000	1.0000	1.0000	1.0000	1.0000
29	1.0000	1.0000	1.0000	1.0000	1.0000
30	1.0000	1.0000	1.0000	1.0000	1.0000
31	1.0000	1.0000	1.0000	1.0000	1.0000
32	1.0000	1.0000	1.0000	1.0000	1.0000
33	1.0000	1.0000	1.0000	1.0000	1.0000
34	1.0000	1.0000	1.0000	1.0000	1.0000
35	1.0000	1.0000	1.0000	1.0000	1.0000
36	1.0000	1.0000	1.0000	1.0000	1.0000
37	1.0000	1.0000	1.0000	1.0000	1.0000
38	1.0000	1.0000	1.0000	1.0000	1.0000
39	1.0000	1.0000	1.0000	1.0000	1.0000
40	1.0000	1.0000	1.0000	1.0000	1.0000
41	1.0000	1.0000	1.0000	1.0000	1.0000
42	1.0000	1.0000	1.0000	1.0000	1.0000
43	1.0000	1.0000	1.0000	1.0000	1.0000
44	1.0000	1.0000	1.0000	1.0000	1.0000
45	1.0000	1.0000	1.0000	1.0000	1.0000
46	1.0000	1.0000	1.0000	1.0000	1.0000
47	1.0000	1.0000	1.0000	1.0000	1.0000
48	1.0000	1.0000	1.0000	1.0000	1.0000
49	1.0000	1.0000	1.0000	1.0000	1.0000
50	1.0000	1.0000	1.0000	1.0000	1.0000

TABLE VIII—Continued

Point	X	Y	Point	X	Y
3-1	5627.37	975.09	4-1	5627.34	927.09
	36	09		33	09
	37	10		33	09
	36	09		33	09
2	5579.36	975.05	2	5579.36	927.06
	36	05		35	07
	36	05		35	07
	36	04		35	07
3	5531.40	975.05	3	5531.43	927.08
	40	05		43	09
	40	05		43	09
	40	05		43	09
4	5483.47	975.08	4	5483.49	927.12
	47	08		49	12
	46	08		49	13
	47	08		49	12
5	5435.50	975.10	5	5435.51	927.13
	50	10		52	13
	49	10		52	13
	49	10		52	14
6	5387.53	975.12	6	5387.52	927.15
	53	12		52	15
	53	12		51	15
	52	12		51	15
7	5339.54	975.12	7	5339.52	927.16
	54	12		52	16
	54	12		51	16
	54	12		51	16
8	5291.59	975.09	8	5291.55	927.13
	58	09		54	13
	58	08		54	13
	58	08		54	14
9	5243.63	975.06	9	5243.60	927.10
	63	07		59	11
	63	06		59	11
	63	06		60	10
10	5195.68	975.06	10	5195.67	927.09
	68	06		67	10
	68	06		67	09
	67	05		66	09
11	5147.64	975.09	11	5147.67	927.08
	64	10		67	09
	65	10		67	09
	64	10		66	08

TABLE VIII--Continued

Point	X	Y	Point	X	Y
5-1	5627.34	879.12	6-1	5627.32	831.15
	34	13		32	16
	34	13		32	16
	34	12		31	16
2	5579.40	879.11	2	5579.38	831.15
	39	12		38	16
	39	12		38	16
	39	11		38	15
3	5531.47	879.13	3	5531.47	831.15
	47	13		46	16
	47	13		47	16
	47	13		47	16
4	5483.53	879.15	4	5483.53	831.16
	53	16		53	17
	53	16		54	17
	53	15		54	17
5	5435.55	879.16	5	5435.56	831.16
	56	17		56	17
	56	17		56	16
	55	17		57	16
6	5387.53	879.19	6	5387.53	831.19
	53	20		53	19
	52	20		53	18
	53	20		53	18
7	5339.51	879.19	7	5339.49	831.20
	51	19		49	20
	50	18		49	19
	50	19		49	20
8	5291.54	879.16	8	5291.52	831.17
	53	16		52	17
	53	16		52	18
	53	15		53	17
9	5243.59	879.14	9	5243.58	831.18
	59	14		58	18
	59	15		57	18
	59	14		57	18
10	5195.67	879.13	10	5195.67	831.19
	67	13		66	19
	67	14		66	19
	67	13		66	19
11	5147.70	879.12	11	5147.70	831.18
	70	13		70	17
	70	13		69	17
	70	13		70	18

[illegible]

TABLE VIII--Continued

Point	X	Y	Point	X	Y
7-1	5627.33	783.19	8-1	5627.35	735.22
	33	20		34	23
	32	20		34	24
	33	19		35	23
2	5579.37	783.18	2	5579.36	735.23
	37	18		36	23
	37	18		36	23
	37	18		36	23
3	5531.45	783.17	3	5531.43	735.21
	45	17		43	21
	46	17		44	21
	46	17		43	21
4	5483.51	783.16	4	5483.49	735.19
	50	16		49	19
	51	16		49	19
	51	16		50	19
5	5435.54	783.13	5	5435.52	735.15
	54	13		52	15
	54	13		53	15
	55	14		53	15
6	5387.53	783.13	6	5387.51	735.15
	53	13		51	16
	53	13		51	16
	52	13		52	16
7	5339.50	783.15	7	5339.51	735.18
	49	16		51	18
	50	16		51	18
	49	15		51	19
8	5291.51	783.14	8	5291.54	735.19
	51	15		54	19
	51	14		54	19
	51	15		55	19
9	5243.57	783.17	9	5243.60	735.23
	57	17		60	23
	57	17		59	23
	57	17		60	22
10	5195.65	783.18	10	5195.66	735.24
	64	19		67	25
	65	20		66	25
	65	19		66	25
11	5147.68	783.18	11	5147.66	735.22
	68	18		66	22
	68	19		66	23
	68	17		67	22

BANKRUPTCY COURT

Y	L	NAME	T	S	DATE
1911	1911	J-5	11.1911	11.1911	1911
1912	1912	12	12.1912	12.1912	1912
1913	1913	13	13.1913	13.1913	1913
1914	1914	14	14.1914	14.1914	1914
1915	1915	15	15.1915	15.1915	1915
1916	1916	16	16.1916	16.1916	1916
1917	1917	17	17.1917	17.1917	1917
1918	1918	18	18.1918	18.1918	1918
1919	1919	19	19.1919	19.1919	1919
1920	1920	20	20.1920	20.1920	1920
1921	1921	21	21.1921	21.1921	1921
1922	1922	22	22.1922	22.1922	1922
1923	1923	23	23.1923	23.1923	1923
1924	1924	24	24.1924	24.1924	1924
1925	1925	25	25.1925	25.1925	1925
1926	1926	26	26.1926	26.1926	1926
1927	1927	27	27.1927	27.1927	1927
1928	1928	28	28.1928	28.1928	1928
1929	1929	29	29.1929	29.1929	1929
1930	1930	30	30.1930	30.1930	1930
1931	1931	31	31.1931	31.1931	1931
1932	1932	32	32.1932	32.1932	1932
1933	1933	33	33.1933	33.1933	1933
1934	1934	34	34.1934	34.1934	1934
1935	1935	35	35.1935	35.1935	1935
1936	1936	36	36.1936	36.1936	1936
1937	1937	37	37.1937	37.1937	1937
1938	1938	38	38.1938	38.1938	1938
1939	1939	39	39.1939	39.1939	1939
1940	1940	40	40.1940	40.1940	1940
1941	1941	41	41.1941	41.1941	1941
1942	1942	42	42.1942	42.1942	1942
1943	1943	43	43.1943	43.1943	1943
1944	1944	44	44.1944	44.1944	1944
1945	1945	45	45.1945	45.1945	1945
1946	1946	46	46.1946	46.1946	1946
1947	1947	47	47.1947	47.1947	1947
1948	1948	48	48.1948	48.1948	1948
1949	1949	49	49.1949	49.1949	1949
1950	1950	50	50.1950	50.1950	1950
1951	1951	51	51.1951	51.1951	1951
1952	1952	52	52.1952	52.1952	1952
1953	1953	53	53.1953	53.1953	1953
1954	1954	54	54.1954	54.1954	1954
1955	1955	55	55.1955	55.1955	1955
1956	1956	56	56.1956	56.1956	1956
1957	1957	57	57.1957	57.1957	1957
1958	1958	58	58.1958	58.1958	1958
1959	1959	59	59.1959	59.1959	1959
1960	1960	60	60.1960	60.1960	1960
1961	1961	61	61.1961	61.1961	1961
1962	1962	62	62.1962	62.1962	1962
1963	1963	63	63.1963	63.1963	1963
1964	1964	64	64.1964	64.1964	1964
1965	1965	65	65.1965	65.1965	1965
1966	1966	66	66.1966	66.1966	1966
1967	1967	67	67.1967	67.1967	1967
1968	1968	68	68.1968	68.1968	1968
1969	1969	69	69.1969	69.1969	1969
1970	1970	70	70.1970	70.1970	1970
1971	1971	71	71.1971	71.1971	1971
1972	1972	72	72.1972	72.1972	1972
1973	1973	73	73.1973	73.1973	1973
1974	1974	74	74.1974	74.1974	1974
1975	1975	75	75.1975	75.1975	1975
1976	1976	76	76.1976	76.1976	1976
1977	1977	77	77.1977	77.1977	1977
1978	1978	78	78.1978	78.1978	1978
1979	1979	79	79.1979	79.1979	1979
1980	1980	80	80.1980	80.1980	1980
1981	1981	81	81.1981	81.1981	1981
1982	1982	82	82.1982	82.1982	1982
1983	1983	83	83.1983	83.1983	1983
1984	1984	84	84.1984	84.1984	1984
1985	1985	85	85.1985	85.1985	1985
1986	1986	86	86.1986	86.1986	1986
1987	1987	87	87.1987	87.1987	1987
1988	1988	88	88.1988	88.1988	1988
1989	1989	89	89.1989	89.1989	1989
1990	1990	90	90.1990	90.1990	1990
1991	1991	91	91.1991	91.1991	1991
1992	1992	92	92.1992	92.1992	1992
1993	1993	93	93.1993	93.1993	1993
1994	1994	94	94.1994	94.1994	1994
1995	1995	95	95.1995	95.1995	1995
1996	1996	96	96.1996	96.1996	1996
1997	1997	97	97.1997	97.1997	1997
1998	1998	98	98.1998	98.1998	1998
1999	1999	99	99.1999	99.1999	1999
2000	2000	100	100.2000	100.2000	2000

TABLE VIII—Continued

Point	X	Y	Point	X	Y
9-1	5627.37	687.25	10-1	5627.43	639.19
	36	25		42	20
	36	25		42	21
	36	25		42	20
2	5579.35	687.27	2	5579.40	639.27
	35	28		39	26
	35	28		40	27
	35	28		39	26
3	5531.40	687.28	3	5531.40	639.29
	41	28		40	30
	41	29		40	30
	40	28		40	29
4	5483.45	687.27	4	5483.43	639.31
	45	27		43	32
	46	28		44	32
	45	28		44	32
5	5435.50	687.24	5	5435.48	639.28
	50	23		48	28
	50	24		48	28
	50	24		48	28
6	5387.51	687.24	6	5387.50	639.29
	51	23		50	29
	51	24		50	29
	51	23		50	29
7	5339.53	687.26	7	5339.53	639.32
	53	26		53	31
	52	27		52	37
	53	26		52	36
8	5291.57	687.25	8	5291.57	639.29
	57	26		57	29
	57	26		57	30
	56	25		57	30
9	5243.62	687.27	9	5243.61	639.29
	61	28		60	29
	61	28		60	29
	61	28		60	29
10	5195.66	687.29	10	5195.63	639.26
	66	28		63	27
	66	28		63	27
	66	28		62	26
11	5147.63	687.23	11	5147.53	639.18
	64	23		53	18
	63	24		53	19
	63	23		53	17

TABLE VIII—Continued

Point	X	Y
11-1	5627.58	591.07
	57	08
	57	08
	56	08
2	5579.45	591.21
	45	22
	45	22
	45	21
3	5531.43	591.29
	41	30
	42	30
	41	31
4	5483.43	591.34
	43	34
	44	35
	43	34
5	5435.46	591.34
	47	34
	46	35
	47	34
6	5387.50	591.35
	49	36
	50	36
	49	35
7	5339.52	591.37
	52	37
	52	37
	52	36
8	5291.54	591.30
	55	31
	55	31
	54	31
9	5243.56	591.27
	55	29
	56	29
	55	29
10	5195.52	591.22
	52	22
	52	23
	52	22
11	5147.38	591.05
	38	06
	37	05
	38	06

[illegible]

TABLE IX

GRID 378 PLATE 49, GRID INTERSECTION COORDINATES

Point	X	Y	Point	X	Y
1-1	5029.59	1060.01	2-1	5029.48	1011.91
	59	02		48	92
	59	01		48	92
	60	01		48	91
2	4981.49	1059.91	2	4981.45	1011.84
	49	91		44	84
	49	90		45	85
	50	91		45	84
3	4933.46	1059.84	3	4933.46	1011.82
	45	84		45	82
	46	85		45	82
	46	84		46	83
4	4885.48	1059.79	4	4885.51	1011.81
	47	81		50	82
	47	80		50	82
	47	81		50	81
5	4837.52	1059.79	5	4837.56	1011.82
	52	79		55	82
	51	79		55	83
	51	80		55	82
6	4789.56	1059.79	6	4789.59	1011.85
	57	80		58	84
	56	80		58	84
	56	79		58	84
7	4741.61	1059.80	7	4741.61	1011.85
	61	81		62	84
	60	81		62	85
	60	80		61	85
8	4693.63	1059.81	8	4693.66	1011.83
	64	83		66	83
	63	82		65	84
	63	82		65	83
9	4645.65	1059.84	9	4645.70	1011.84
	65	85		70	84
	66	86		70	85
	65	86		69	85
10	4597.61	1059.94	10	4597.71	1011.88
	61	95		70	89
	61	95		70	89
	61	94		70	88
11	4549.48	1060.07	11	4549.62	1011.95
	49	06		61	95
	48	06		62	95
	48	06		61	95

TABLE 22

GROSS VALUE ADDED IN THE MANUFACTURING SECTOR

Year	1	2	3	4
1951	100.0	100.0	100.0	100.0
1952	101.5	101.5	101.5	101.5
1953	103.0	103.0	103.0	103.0
1954	104.5	104.5	104.5	104.5
1955	106.0	106.0	106.0	106.0
1956	107.5	107.5	107.5	107.5
1957	109.0	109.0	109.0	109.0
1958	110.5	110.5	110.5	110.5
1959	112.0	112.0	112.0	112.0
1960	113.5	113.5	113.5	113.5
1961	115.0	115.0	115.0	115.0
1962	116.5	116.5	116.5	116.5
1963	118.0	118.0	118.0	118.0
1964	119.5	119.5	119.5	119.5
1965	121.0	121.0	121.0	121.0
1966	122.5	122.5	122.5	122.5
1967	124.0	124.0	124.0	124.0
1968	125.5	125.5	125.5	125.5
1969	127.0	127.0	127.0	127.0
1970	128.5	128.5	128.5	128.5
1971	130.0	130.0	130.0	130.0

TABLE IX—Continued

Point	X	Y	Point	X	Y
3-1	5029.43	963.90	4-1	5029.40	915.89
	43	91		39	90
	42	91		39	90
	42	90		40	89
2	4981.42	963.86	2	4981.41	915.87
	42	87		40	88
	41	86		40	89
	42	86		41	88
3	4933.46	963.86	3	4933.46	915.90
	46	85		48	91
	46	85		47	90
	46	86		47	91
4	4885.52	963.89	4	4885.54	915.93
	52	90		55	93
	51	90		54	94
	52	90		54	94
5	4837.56	963.91	5	4837.58	915.95
	56	91		59	94
	55	92		57	94
	55	92		57	95
6	4789.59	963.92	6	4789.58	915.97
	59	93		58	97
	58	92		58	97
	58	92		58	97
7	4741.61	963.93	7	4741.57	915.97
	60	93		58	98
	60	93		57	97
	60	93		57	98
8	4693.64	963.90	8	4693.61	915.94
	63	91		60	95
	63	91		60	95
	63	90		60	94
9	4645.69	963.88	9	4645.66	915.93
	70	89		66	93
	69	88		66	93
	69	89		66	92
10	4597.74	963.89	10	4597.73	915.91
	74	90		73	92
	74	90		73	91
	74	89		72	91
11	4549.70	963.94	11	4549.73	915.92
	71	95		73	92
	70	95		73	93
	71	94		73	92

Y	A	Value	Z	Q	Value
0.00	0.0000	0.00	0.00	0.0000	0.00
0.01	0.0001	0.01	0.01	0.0001	0.01
0.02	0.0004	0.02	0.02	0.0004	0.02
0.03	0.0009	0.03	0.03	0.0009	0.03
0.04	0.0016	0.04	0.04	0.0016	0.04
0.05	0.0025	0.05	0.05	0.0025	0.05
0.06	0.0036	0.06	0.06	0.0036	0.06
0.07	0.0049	0.07	0.07	0.0049	0.07
0.08	0.0064	0.08	0.08	0.0064	0.08
0.09	0.0081	0.09	0.09	0.0081	0.09
0.10	0.0100	0.10	0.10	0.0100	0.10
0.11	0.0121	0.11	0.11	0.0121	0.11
0.12	0.0144	0.12	0.12	0.0144	0.12
0.13	0.0169	0.13	0.13	0.0169	0.13
0.14	0.0196	0.14	0.14	0.0196	0.14
0.15	0.0225	0.15	0.15	0.0225	0.15
0.16	0.0256	0.16	0.16	0.0256	0.16
0.17	0.0289	0.17	0.17	0.0289	0.17
0.18	0.0324	0.18	0.18	0.0324	0.18
0.19	0.0361	0.19	0.19	0.0361	0.19
0.20	0.0400	0.20	0.20	0.0400	0.20
0.21	0.0441	0.21	0.21	0.0441	0.21
0.22	0.0484	0.22	0.22	0.0484	0.22
0.23	0.0529	0.23	0.23	0.0529	0.23
0.24	0.0576	0.24	0.24	0.0576	0.24
0.25	0.0625	0.25	0.25	0.0625	0.25
0.26	0.0676	0.26	0.26	0.0676	0.26
0.27	0.0729	0.27	0.27	0.0729	0.27
0.28	0.0784	0.28	0.28	0.0784	0.28
0.29	0.0841	0.29	0.29	0.0841	0.29
0.30	0.0900	0.30	0.30	0.0900	0.30
0.31	0.0961	0.31	0.31	0.0961	0.31
0.32	0.1024	0.32	0.32	0.1024	0.32
0.33	0.1089	0.33	0.33	0.1089	0.33
0.34	0.1156	0.34	0.34	0.1156	0.34
0.35	0.1225	0.35	0.35	0.1225	0.35
0.36	0.1296	0.36	0.36	0.1296	0.36
0.37	0.1369	0.37	0.37	0.1369	0.37
0.38	0.1444	0.38	0.38	0.1444	0.38
0.39	0.1521	0.39	0.39	0.1521	0.39
0.40	0.1600	0.40	0.40	0.1600	0.40
0.41	0.1681	0.41	0.41	0.1681	0.41
0.42	0.1764	0.42	0.42	0.1764	0.42
0.43	0.1849	0.43	0.43	0.1849	0.43
0.44	0.1936	0.44	0.44	0.1936	0.44
0.45	0.2025	0.45	0.45	0.2025	0.45
0.46	0.2116	0.46	0.46	0.2116	0.46
0.47	0.2209	0.47	0.47	0.2209	0.47
0.48	0.2304	0.48	0.48	0.2304	0.48
0.49	0.2401	0.49	0.49	0.2401	0.49
0.50	0.2500	0.50	0.50	0.2500	0.50

TABLE IX—Continued

Point	X	Y	Point	X	Y
5-1	5029.39	867.93	6-1	5029.37	819.97
	39	94		36	97
	38	94		36	98
	38	94		37	98
2	4981.44	867.93	2	4981.43	819.96
	44	93		43	97
	44	93		43	97
	44	93		42	97
3	4933.51	867.94	3	4933.52	819.97
	52	94		51	98
	51	94		51	98
	52	94		51	98
4	4885.59	867.96	4	4885.58	819.98
	58	96		58	97
	58	97		58	98
	58	97		58	98
5	4837.61	867.98	5	4837.62	819.97
	61	98		61	97
	61	98		62	98
	60	98		62	97
6	4789.60	868.01	6	4789.58	820.00
	59	01		58	00
	58	01		58	00
	59	01		58	00
7	4741.57	868.01	7	4741.55	820.01
	57	01		54	01
	57	02		54	01
	57	01		55	01
8	4693.59	867.97	8	4693.57	819.98
	58	97		57	99
	58	98		56	98
	58	97		56	98
9	4645.65	867.96	9	4645.64	820.01
	65	96		64	01
	64	97		63	00
	64	96		63	00
10	4597.73	867.96	10	4597.72	820.00
	72	96		71	02
	73	96		71	01
	72	95		71	01
11	4549.76	867.96	11	4549.75	820.00
	75	96		75	00
	75	96		74	00
	75	95		75	00

Table 1.1. Summary of data

Year	Area	Population	Area	Population	Area
1950	1000	1000	1000	1000	1000
1951	1000	1000	1000	1000	1000
1952	1000	1000	1000	1000	1000
1953	1000	1000	1000	1000	1000
1954	1000	1000	1000	1000	1000
1955	1000	1000	1000	1000	1000
1956	1000	1000	1000	1000	1000
1957	1000	1000	1000	1000	1000
1958	1000	1000	1000	1000	1000
1959	1000	1000	1000	1000	1000
1960	1000	1000	1000	1000	1000
1961	1000	1000	1000	1000	1000
1962	1000	1000	1000	1000	1000
1963	1000	1000	1000	1000	1000
1964	1000	1000	1000	1000	1000
1965	1000	1000	1000	1000	1000
1966	1000	1000	1000	1000	1000
1967	1000	1000	1000	1000	1000
1968	1000	1000	1000	1000	1000
1969	1000	1000	1000	1000	1000
1970	1000	1000	1000	1000	1000
1971	1000	1000	1000	1000	1000
1972	1000	1000	1000	1000	1000
1973	1000	1000	1000	1000	1000
1974	1000	1000	1000	1000	1000
1975	1000	1000	1000	1000	1000
1976	1000	1000	1000	1000	1000
1977	1000	1000	1000	1000	1000
1978	1000	1000	1000	1000	1000
1979	1000	1000	1000	1000	1000
1980	1000	1000	1000	1000	1000
1981	1000	1000	1000	1000	1000
1982	1000	1000	1000	1000	1000
1983	1000	1000	1000	1000	1000
1984	1000	1000	1000	1000	1000
1985	1000	1000	1000	1000	1000
1986	1000	1000	1000	1000	1000
1987	1000	1000	1000	1000	1000
1988	1000	1000	1000	1000	1000
1989	1000	1000	1000	1000	1000
1990	1000	1000	1000	1000	1000
1991	1000	1000	1000	1000	1000
1992	1000	1000	1000	1000	1000
1993	1000	1000	1000	1000	1000
1994	1000	1000	1000	1000	1000
1995	1000	1000	1000	1000	1000
1996	1000	1000	1000	1000	1000
1997	1000	1000	1000	1000	1000
1998	1000	1000	1000	1000	1000
1999	1000	1000	1000	1000	1000
2000	1000	1000	1000	1000	1000
2001	1000	1000	1000	1000	1000
2002	1000	1000	1000	1000	1000
2003	1000	1000	1000	1000	1000
2004	1000	1000	1000	1000	1000
2005	1000	1000	1000	1000	1000
2006	1000	1000	1000	1000	1000
2007	1000	1000	1000	1000	1000
2008	1000	1000	1000	1000	1000
2009	1000	1000	1000	1000	1000
2010	1000	1000	1000	1000	1000
2011	1000	1000	1000	1000	1000
2012	1000	1000	1000	1000	1000
2013	1000	1000	1000	1000	1000
2014	1000	1000	1000	1000	1000
2015	1000	1000	1000	1000	1000
2016	1000	1000	1000	1000	1000
2017	1000	1000	1000	1000	1000
2018	1000	1000	1000	1000	1000
2019	1000	1000	1000	1000	1000
2020	1000	1000	1000	1000	1000

TABLE IX--Continued

Point	X	Y	Point	X	Y
7-1	5029.37	772.00	8-1	5029.39	724.04
	37	01		39	04
	37	01		39	05
	36	00		39	05
2	4981.41	771.99	2	4981.40	724.04
	41	99		41	05
	41	72.00		40	05
	41	99		41	05
3	4933.50	771.98	3	4933.48	724.03
	50	98		48	03
	50	98		48	03
	50	97		48	03
4	4885.56	771.97	4	4885.54	724.00
	56	97		54	01
	56	97		54	01
	56	98		54	01
5	4837.59	771.95	5	4837.57	723.97
	59	95		56	97
	59	95		57	97
	59	94		56	97
6	4789.58	771.96	6	4789.56	723.97
	57	95		56	98
	56	95		56	97
	57	96		56	97
7	4741.55	771.96	7	4741.56	724.00
	55	96		57	00
	54	97		57	00
	54	96		57	00
8	4693.56	771.95	8	4693.59	724.01
	55	96		59	01
	56	96		59	01
	56	96		60	01
9	4645.62	771.98	9	4645.65	724.06
	61	99		64	05
	61	99		64	05
	61	99		65	05
10	4597.69	772.01	10	4597.71	724.08
	69	02		71	08
	70	01		71	08
	69	01		71	07
11	4549.73	772.00	11	4549.71	724.06
	73	01		72	07
	72	01		71	05
	73	00		72	05

TABLE IX--Continued

Point	X	Y	Point	X	Y
9-1	5029.40	676.08	10-1	5029.48	628.02
	41	08		48	01
	40	08		47	03
	40	08		47	03
2	4981.41	676.10	2	4981.44	628.08
	40	10		44	08
	40	10		43	09
	40	10		43	09
3	4933.45	676.09	3	4933.45	628.11
	46	08		45	11
	46	09		45	11
	45	09		44	11
4	4885.50	676.09	4	4885.48	628.13
	50	09		48	13
	50	09		48	13
	50	09		48	12
5	4837.54	676.05	5	4837.53	628.10
	55	05		53	10
	54	05		53	10
	54	06		53	10
6	4789.56	676.05	6	4789.55	628.10
	56	06		56	10
	55	06		56	10
	56	06		55	10
7	4741.58	676.07	7	4741.58	628.12
	58	07		58	13
	57	08		58	13
	57	07		58	13
8	4693.61	676.07	8	4693.62	628.11
	61	07		61	11
	61	07		61	11
	61	07		62	11
9	4645.67	676.09	9	4645.66	628.11
	67	09		65	11
	67	09		65	11
	67	09		65	12
10	4597.71	676.10	10	4597.66	628.11
	70	12		67	10
	70	11		67	10
	70	11		66	10
11	4549.69	676.06	11	4549.58	628.01
	68	07		57	00
	68	07		57	01
	69	07		57	01

TABLE 1. - SUMMARY OF DATA

Year	1	2	3	4	5
1950	100	100	100	100	100
1951	100	100	100	100	100
1952	100	100	100	100	100
1953	100	100	100	100	100
1954	100	100	100	100	100
1955	100	100	100	100	100
1956	100	100	100	100	100
1957	100	100	100	100	100
1958	100	100	100	100	100
1959	100	100	100	100	100
1960	100	100	100	100	100
1961	100	100	100	100	100
1962	100	100	100	100	100
1963	100	100	100	100	100
1964	100	100	100	100	100
1965	100	100	100	100	100
1966	100	100	100	100	100
1967	100	100	100	100	100
1968	100	100	100	100	100
1969	100	100	100	100	100
1970	100	100	100	100	100
1971	100	100	100	100	100
1972	100	100	100	100	100
1973	100	100	100	100	100
1974	100	100	100	100	100
1975	100	100	100	100	100
1976	100	100	100	100	100
1977	100	100	100	100	100
1978	100	100	100	100	100
1979	100	100	100	100	100
1980	100	100	100	100	100
1981	100	100	100	100	100
1982	100	100	100	100	100
1983	100	100	100	100	100
1984	100	100	100	100	100
1985	100	100	100	100	100
1986	100	100	100	100	100
1987	100	100	100	100	100
1988	100	100	100	100	100
1989	100	100	100	100	100
1990	100	100	100	100	100
1991	100	100	100	100	100
1992	100	100	100	100	100
1993	100	100	100	100	100
1994	100	100	100	100	100
1995	100	100	100	100	100
1996	100	100	100	100	100
1997	100	100	100	100	100
1998	100	100	100	100	100
1999	100	100	100	100	100
2000	100	100	100	100	100
2001	100	100	100	100	100
2002	100	100	100	100	100
2003	100	100	100	100	100
2004	100	100	100	100	100
2005	100	100	100	100	100
2006	100	100	100	100	100
2007	100	100	100	100	100
2008	100	100	100	100	100
2009	100	100	100	100	100
2010	100	100	100	100	100
2011	100	100	100	100	100
2012	100	100	100	100	100
2013	100	100	100	100	100
2014	100	100	100	100	100
2015	100	100	100	100	100
2016	100	100	100	100	100
2017	100	100	100	100	100
2018	100	100	100	100	100
2019	100	100	100	100	100
2020	100	100	100	100	100

TABLE IX--Continued

Point	X	T
11-1	5029.62	579.89
	63	90
	62	90
	61	89
2	4981.49	580.04
	50	04
	50	04
	49	03
3	4933.47	580.10
	47	10
	47	11
	47	10
4	4885.48	580.16
	48	15
	48	16
	48	16
5	4837.52	580.16
	51	16
	51	16
	50	16
6	4789.55	580.17
	55	17
	54	17
	54	18
7	4741.57	580.18
	57	18
	57	18
	56	18
8	4693.59	580.12
	59	13
	59	13
	59	13
9	4645.60	580.09
	61	10
	61	10
	60	09
10	4597.56	580.02
	56	02
	56	03
	56	03
11	4549.42	579.86
	43	85
	42	86
	43	85

TABLE X

GRID 377 PLATE 50, GRID INTERSECTION COORDINATES

Point	X	Y	Point	X	Y
1-1	231.93	240.06	2-1	231.85	191.95
	93	04		86	94
	94	04		84	94
	94	05		85	96
2	183.86	239.95	2	183.81	191.88
	86	94		81	89
	86	94		80	88
	86	95		81	88
3	135.84	239.86	3	135.82	191.86
	83	87		81	86
	84	87		82	86
	84	88		82	86
4	87.85	239.84	4	87.85	191.87
	84	83		86	87
	84	84		86	87
	84	84		86	87
5	39.89	239.82	5	39.90	191.87
	88	81		90	88
	90	82		89	87
	90	83		90	87
6	9991.94	239.83	6	9991.95	191.89
	93	83		95	89
	93	83		95	89
	94	83		95	89
7	9943.97	239.83	7	9943.98	191.88
	96	83		98	88
	97	83		98	88
	97	84		98	88
8	9896.01	239.85	8	9896.02	191.87
	01	85		02	86
	00	84		02	86
	01	85		02	86
9	9848.02	239.87	9	9848.06	191.86
	02	89		07	87
	01	88		06	86
	02	88		06	86
10	9799.99	239.95	10	9800.07	191.89
	99	95		06	89
	98	94		06	89
	98	95		06	90
11	9751.85	240.09	11	9751.98	191.95
	85	10		98	95
	84	09		98	95
	85	08		98	95

TABLE 1

MEAN AIR TEMPERATURE AND RELATIVE HUMIDITY

Month	1	2	3	4	5	6
1-1	10.2	10.2	10.2	10.2	10.2	10.2
2	10.2	10.2	10.2	10.2	10.2	10.2
3	10.2	10.2	10.2	10.2	10.2	10.2
4	10.2	10.2	10.2	10.2	10.2	10.2
5	10.2	10.2	10.2	10.2	10.2	10.2
6	10.2	10.2	10.2	10.2	10.2	10.2
7	10.2	10.2	10.2	10.2	10.2	10.2
8	10.2	10.2	10.2	10.2	10.2	10.2
9	10.2	10.2	10.2	10.2	10.2	10.2
10	10.2	10.2	10.2	10.2	10.2	10.2
11	10.2	10.2	10.2	10.2	10.2	10.2
12	10.2	10.2	10.2	10.2	10.2	10.2

TABLE X--Continued

Point	X	Y	Point	X	Y
3-1	231.79	143.93	4-1	231.75	95.94
	80	93		76	93
	79	93		76	93
	79	93		76	92
2	183.79	143.88	2	183.78	95.92
	79	88		78	92
	79	88		79	92
	79	88		79	92
3	135.83	143.89	3	135.85	95.95
	83	90		85	95
	83	89		85	95
	83	90		85	95
4	87.90	143.93	4	87.92	95.98
	90	93		92	98
	90	92		92	99
	90	93		92	98
5	39.93	143.94	5	39.95	96.00
	94	94		95	00
	93	94		94	00
	93	95		95	00
6	9991.95	143.96	6	9991.95	96.02
	96	96		95	02
	95	96		95	01
	95	96		95	01
7	9943.98	143.97	7	9943.96	96.01
	97	96		95	01
	98	96		94	01
	97	96		95	01
8	9896.01	143.94	8	9895.99	95.97
	01	93		98	97
	01	93		98	97
	01	94		98	96
9	9848.07	143.91	9	9848.04	95.96
	06	91		03	95
	06	91		03	96
	06	91		03	95
10	9800.11	143.90	10	9800.10	95.93
	11	90		09	93
	11	90		09	93
	10	90		10	92
11	9752.07	143.96	11	9752.11	95.93
	07	95		10	93
	07	95		11	93
	07	95		11	92

TABLE X--Continued

Point	X	Y	Point	X	Y
5-1	231.76	47.98	6-1	231.74	0.02
	76	97		74	02
	76	97		75	02
	76	96		75	02
2	183.81	47.97	2	183.81	0.01
	81	97		81	01
	81	96		81	01
	81	96		81	02
3	135.89	47.98	3	135.90	0.02
	89	98		90	02
	90	98		90	01
	89	98		90	01
4	87.97	48.02	4	87.97	0.03
	97	01		97	04
	97	01		97	03
	96	01		97	03
5	39.98	48.02	5	40.01	0.01
	98	02		01	01
	99	02		01	01
	98	02		00	01
6	9991.97	48.05	6	9991.97	0.02
	97	06		97	02
	96	05		97	03
	96	04		97	03
7	9943.93	48.05	7	9943.93	0.03
	93	04		93	03
	93	06		93	03
	93	05		92	03
8	9895.97	48.01	8	9895.95	0.02
	96	00		94	01
	97	01		95	02
	97	00		95	01
9	9848.03	47.98	9	9848.01	0.01
	02	99		01	01
	02	99		02	01
	01	98		01	01
10	9800.10	47.97	10	9800.07	0.01
	09	98		08	02
	10	98		08	01
	09	97		08	02
11	9752.13	47.96	11	9752.13	0.00
	12	97		12	00
	13	96		11	01
	13	96		12	01

1	2	3	4	5	6
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
10	10	10	10	10	10
11	11	11	11	11	11
12	12	12	12	12	12
13	13	13	13	13	13
14	14	14	14	14	14
15	15	15	15	15	15
16	16	16	16	16	16
17	17	17	17	17	17
18	18	18	18	18	18
19	19	19	19	19	19
20	20	20	20	20	20
21	21	21	21	21	21
22	22	22	22	22	22
23	23	23	23	23	23
24	24	24	24	24	24
25	25	25	25	25	25
26	26	26	26	26	26
27	27	27	27	27	27
28	28	28	28	28	28
29	29	29	29	29	29
30	30	30	30	30	30
31	31	31	31	31	31
32	32	32	32	32	32
33	33	33	33	33	33
34	34	34	34	34	34
35	35	35	35	35	35
36					

TABLE X--Continued

Point	X	Y	Point	X	Y
7-1	231.75	9952.03	8-1	231.78	9904.07
	76	04		78	08
	76	04		78	06
	76	04		78	08
2	183.79	9952.02	2	183.79	9904.09
	79	02		80	09
	79	02		80	09
	79	03		80	08
3	135.88	9952.01	3	135.88	9904.08
	87	02		87	07
	89	01		88	07
	88	01		88	07
4	87.94	9952.00	4	87.93	9904.06
	94	00		93	06
	95	00		93	05
	95	01		94	05
5	39.97	9951.99	5	39.97	9904.01
	96	98		96	01
	96	98		97	00
	97	98		97	01
6	9991.95	9951.99	6	9991.97	9904.01
	94	99		96	01
	94	99		97	00
	94	98		97	00
7	9943.90	9952.00	7	9943.95	9904.03
	91	00		96	04
	91	00		96	03
	91	00		95	03
8	9895.94	9952.00	8	9895.98	9904.02
	94	00		98	02
	93	00		99	03
	93	9951.99		98	02
9	9847.99	9952.02	9	9848.03	9904.06
	99	02		02	06
	9848.00	02		03	06
	00	02		02	06
10	9800.07	9952.03	10	9800.09	9904.07
	07	03		09	07
	07	03		09	06
	07	02		08	07
11	9752.10	9952.02	11	9752.10	9904.04
	09	02		08	05
	10	01		09	05
	09	01		08	06

TABLE 1

Year	1	2	3	4	5
1950	100	100	100	100	100
1951	100	100	100	100	100
1952	100	100	100	100	100
1953	100	100	100	100	100
1954	100	100	100	100	100
1955	100	100	100	100	100
1956	100	100	100	100	100
1957	100	100	100	100	100
1958	100	100	100	100	100
1959	100	100	100	100	100
1960	100	100	100	100	100
1961	100	100	100	100	100
1962	100	100	100	100	100
1963	100	100	100	100	100
1964	100	100	100	100	100
1965	100	100	100	100	100
1966	100	100	100	100	100
1967	100	100	100	100	100
1968	100	100	100	100	100
1969	100	100	100	100	100
1970	100	100	100	100	100
1971	100	100	100	100	100
1972	100	100	100	100	100
1973	100	100	100	100	100
1974	100	100	100	100	100
1975	100	100	100	100	100
1976	100	100	100	100	100
1977	100	100	100	100	100
1978	100	100	100	100	100
1979	100	100	100	100	100
1980	100	100	100	100	100
1981	100	100	100	100	100
1982	100	100	100	100	100
1983	100	100	100	100	100
1984	100	100	100	100	100
1985	100	100	100	100	100
1986	100	100	100	100	100
1987	100	100	100	100	100
1988	100	100	100	100	100
1989	100	100	100	100	100
1990	100	100	100	100	100
1991	100	100	100	100	100
1992	100	100	100	100	100
1993	100	100	100	100	100
1994	100	100	100	100	100
1995	100	100	100	100	100
1996	100	100	100	100	100
1997	100	100	100	100	100
1998	100	100	100	100	100
1999	100	100	100	100	100
2000	100	100	100	100	100
2001	100	100	100	100	100
2002	100	100	100	100	100
2003	100	100	100	100	100
2004	100	100	100	100	100
2005	100	100	100	100	100
2006	100	100	100	100	100
2007	100	100	100	100	100
2008	100	100	100	100	100
2009	100	100	100	100	100
2010	100	100	100	100	100
2011	100	100	100	100	100
2012	100	100	100	100	100
2013	100	100	100	100	100
2014	100	100	100	100	100
2015	100	100	100	100	100
2016	100	100	100	100	100
2017	100	100	100	100	100
2018	100	100	100	100	100
2019	100	100	100	100	100
2020	100	100	100	100	100

TABLE X—Continued

Point	X	Y	Point	X	Y
9-1	231.80	9856.09	10-1	231.86	9808.04
	80	09		87	05
	80	10		86	05
	80	09		86	04
2	183.79	9856.12	2	183.82	9808.11
	79	12		83	11
	80	12		83	11
	79	12		82	11
3	135.82	9856.13	3	135.83	9808.14
	83	12		83	13
	83	12		83	13
	83	13		83	12
4	87.88	9856.12	4	87.85	9808.16
	88	12		86	16
	89	12		86	16
	88	11		86	16
5	39.93	9856.08	5	39.90	9808.13
	92	07		90	12
	92	08		90	13
	93	07		90	12
6	9991.94	9856.08	6	9991.94	9808.13
	95	08		93	12
	94	08		93	13
	94	08		93	12
7	9943.95	9856.11	7	9943.96	9808.14
	94	11		96	14
	94	11		96	14
	94	11		96	14
8	9895.99	9856.09	8	9896.00	9808.12
	99	09		00	12
	99	10		9895.99	13
	98	10		99	12
9	9848.03	9856.13	9	9848.02	9808.11
	03	11		02	11
	03	12		02	12
	03	11		01	12
10	9800.08	9856.12	10	9800.01	9808.08
	08	12		02	09
	07	12		01	09
	07	12		02	08
11	9752.05	9856.07	11	9751.94	9808.00
	05	08		95	00
	06	07		96	00
	04	06		94	00

TABLE X—Continued

Point	X	Y
11-1	232.02	9759.93
	01	93
	01	94
	01	94
2	183.89	9760.07
	90	07
	90	07
	90	06
3	135.86	9760.11
	86	12
	86	12
	86	12
4	87.88	9760.19
	87	19
	88	20
	88	19
5	39.92	9760.17
	91	18
	92	19
	91	19
6	9991.94	9760.19
	94	19
	94	19
	94	19
7	9943.96	9760.19
	96	20
	96	20
	95	20
8	9895.99	9760.16
	98	15
	98	15
	98	15
9	9847.99	9760.11
	9848.00	12
	00	12
	00	11
10	9799.96	9760.06
	97	06
	97	05
	97	06
11	9751.81	9759.88
	82	87
	82	87
	81	87

TABLE XI

GRID 378 PLATE 50, GRID INTERSECTION COORDINATES

Point	X	Y	Point	X	Y
1-1	5673.43	1016.29	2-1	5673.33	968.21
	43	29		34	21
	43	29		33	21
	43	29		33	21
2	5625.35	1016.21	2	5625.28	968.15
	35	20		28	14
	34	20		28	14
	35	20		28	14
3	5577.32	1016.12	3	5577.30	968.14
	33	13		31	13
	32	13		31	13
	32	14		30	13
4	5529.34	1016.10	4	5529.35	968.15
	35	10		35	15
	34	10		34	15
	34	10		34	16
5	5481.39	1016.10	5	5481.39	968.16
	40	09		40	16
	38	09		39	16
	39	10		39	15
6	5433.43	1016.12	6	5433.44	968.18
	44	11		44	17
	43	11		45	18
	43	12		44	18
7	5385.47	1016.12	7	5385.47	968.17
	47	11		48	17
	46	12		48	17
	47	11		47	17
8	5337.52	1016.12	8	5337.51	968.16
	51	13		52	16
	51	13		51	15
	51	12		51	15
9	5289.53	1016.17	9	5289.56	968.16
	53	16		56	16
	53	16		56	15
	52	17		55	15
10	5241.50	1016.23	10	5241.56	968.19
	49	23		55	19
	49	23		55	18
	49	24		55	18
11	5193.36	1016.36	11	5193.48	968.25
	36	36		48	24
	36	37		48	24
	36	37		47	25

Table 2

Estimated probabilities of infection from various sources

Source	1	2	3	4	5
1-2	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000

TABLE XI--Continued

Point	X	Y	Point	X	Y
3-1	5673.26	920.19	4-1	5673.23	872.20
	26	19		23	20
	25	19		23	20
	25	19		22	20
2	5625.26	920.17	2	5625.25	872.21
	26	17		26	21
	25	16		25	20
	26	17		26	21
3	5577.30	920.18	3	5577.33	872.24
	31	18		33	23
	31	18		33	23
	31	18		33	23
4	5529.38	920.23	4	5529.39	872.29
	38	23		39	28
	37	22		40	28
	37	23		39	28
5	5481.42	920.24	5	5481.42	872.30
	41	24		43	30
	42	25		43	31
	41	24		42	31
6	5433.43	920.26	6	5433.43	872.33
	43	26		43	32
	43	26		44	33
	42	26		43	33
7	5385.46	920.26	7	5385.44	872.32
	46	27		43	32
	45	27		43	33
	46	27		43	33
8	5337.49	920.24	8	5337.45	972.28
	50	24		46	29
	50	24		46	28
	49	23		45	28
9	5289.55	920.21	9	5289.51	872.26
	55	21		51	26
	55	21		50	27
	55	21		51	26
10	5241.60	920.20	10	5241.58	872.24
	60	19		58	24
	59	20		58	24
	59	20		57	24
11	5193.56	920.24	11	5193.60	872.22
	57	23		59	23
	56	23		59	23
	57	23		59	23

TABLE KI--Continued

Point	X	Y	Point	X	Y
5-1	5673.23	824.24	6-1	5673.21	776.29
	23	24		22	28
	22	23		21	28
	22	24		22	28
2	5625.28	824.25	2	5625.28	776.29
	29	25		27	28
	28	25		28	29
	28	25		28	30
3	5577.37	824.27	3	5577.37	776.31
	37	27		38	30
	38	26		38	29
	37	27		37	31
4	5529.44	824.31	4	5529.44	776.32
	44	31		44	32
	45	31		44	32
	44	31		43	33
5	5481.46	824.33	5	5481.46	776.31
	46	32		47	31
	46	32		47	31
	46	33		47	31
6	5433.44	824.35	6	5433.46	776.32
	43	35		45	32
	44	35		45	32
	44	35		45	32
7	5385.42	824.36	7	5385.41	776.33
	42	36		40	34
	41	35		40	34
	41	36		40	33
8	5337.44	824.32	8	5337.41	776.32
	43	32		42	33
	43	32		42	32
	43	32		41	33
9	5289.50	824.30	9	5289.48	776.32
	50	30		46	33
	49	30		48	33
	49	30		48	33
10	5241.57	824.28	10	5241.56	776.33
	57	29		55	33
	57	28		56	32
	56	29		55	33
11	5193.59	824.26	11	5193.58	776.31
	59	25		59	31
	60	25		59	31
	59	26		59	31

TABLE 1.—Continued

State	1	2	3	4	5
26	1972	1973	1974	1975	1976
27	1977	1978	1979	1980	1981
28	1982	1983	1984	1985	1986
29	1987	1988	1989	1990	1991
30	1992	1993	1994	1995	1996
31	1997	1998	1999	2000	2001
32	2002	2003	2004	2005	2006
33	2007	2008	2009	2010	2011
34	2012	2013	2014	2015	2016
35	2017	2018	2019	2020	2021
36	2022	2023	2024	2025	2026
37	2027	2028	2029	2030	2031
38	2032	2033	2034	2035	2036
39	2037	2038	2039	2040	2041
40	2042	2043	2044	2045	2046
41	2047	2048	2049	2050	2051
42	2052	2053	2054	2055	2056
43	2057	2058	2059	2060	2061
44	2062	2063	2064	2065	2066
45	2067	2068	2069	2070	2071
46	2072	2073	2074	2075	2076
47	2077	2078	2079	2080	2081
48	2082	2083	2084	2085	2086
49	2087	2088	2089	2090	2091
50	2092	2093	2094	2095	2096
51	2097	2098	2099	2100	2101
52	2102	2103	2104	2105	2106
53	2107	2108	2109	2110	2111
54	2112	2113	2114	2115	2116
55	2117	2118	2119	2120	2121
56	2122	2123	2124	2125	2126
57	2127	2128	2129	2130	2131
58	2132	2133	2134	2135	2136
59	2137	2138	2139	2140	2141
60	2142	2143	2144	2145	2146
61	2147	2148	2149	2150	2151
62	2152	2153	2154	2155	2156
63	2157	2158	2159	2160	2161
64	2162	2163	2164	2165	2166
65	2167	2168	2169	2170	2171
66	2172	2173	2174	2175	2176
67	2177	2178	2179	2180	2181
68	2182	2183	2184	2185	2186
69	2187	2188	2189	2190	2191
70	2192	2193	2194	2195	2196
71	2197	2198	2199	2200	2201
72	2202	2203	2204	2205	2206
73	2207	2208	2209	2210	2211
74	2212	2213	2214	2215	2216
75	2217	2218	2219	2220	2221
76	2222	2223	2224	2225	2226
77	2227	2228	2229	2230	2231
78	2232	2233	2234	2235	2236
79	2237	2238	2239	2240	2241
80	2242	2243	2244	2245	2246
81	2247	2248	2249	2250	2251
82	2252	2253	2254	2255	2256
83	2257	2258	2259	2260	2261
84	2262	2263	2264	2265	2266
85	2267	2268	2269	2270	2271
86	2272	2273	2274	2275	2276
87	2277	2278	2279	2280	2281
88	2282	2283	2284	2285	2286
89	2287	2288	2289	2290	2291
90	2292	2293	2294	2295	2296
91	2297	2298	2299	2300	2301
92	2302	2303	2304	2305	2306
93	2307	2308	2309	2310	2311
94	2312	2313	2314	2315	2316
95	2317	2318	2319	2320	2321
96	2322	2323	2324	2325	2326
97	2327	2328	2329	2330	2331
98	2332	2333	2334	2335	2336
99	2337	2338	2339	2340	2341
100	2342	2343	2344	2345	2346

TABLE XI—Continued

Point	X	Y	Point	X	Y
7-1	5673.20	728.31	8-1	5673.23	680.35
	21	30		23	36
	21	31		22	35
	21	31		23	36
2	5625.24	728.31	2	5625.25	680.36
	25	30		25	36
	25	31		25	35
	25	31		25	37
3	5577.34	728.31	3	5577.32	680.36
	34	31		32	36
	34	31		32	35
	34	30		32	37
4	5529.40	728.30	4	5529.38	680.35
	40	30		39	35
	40	30		39	34
	40	30		39	35
5	5481.43	728.29	5	5481.42	680.32
	44	27		42	31
	45	28		42	31
	44	28		42	32
6	5433.41	728.29	6	5433.42	680.30
	41	28		42	30
	40	29		43	31
	41	28		42	31
7	5385.37	728.30	7	5385.42	680.34
	37	30		42	33
	37	30		42	34
	38	30		41	34
8	5337.40	728.31	8	5337.45	680.33
	40	31		44	32
	40	31		45	32
	39	31		44	33
9	5289.47	728.34	9	5289.50	680.36
	47	33		50	36
	47	33		49	36
	48	34		49	36
10	5241.53	728.35	10	5241.56	680.38
	54	34		56	38
	54	34		55	38
	54	35		55	38
11	5193.56	728.31	11	5193.56	680.36
	57	31		55	34
	57	32		56	35
	57	32		55	34

TABLE 1. 1957

Year	1	2	3	4	5
1957	100	100	100	100	100
1958	100	100	100	100	100
1959	100	100	100	100	100
1960	100	100	100	100	100
1961	100	100	100	100	100
1962	100	100	100	100	100
1963	100	100	100	100	100
1964	100	100	100	100	100
1965	100	100	100	100	100
1966	100	100	100	100	100
1967	100	100	100	100	100
1968	100	100	100	100	100
1969	100	100	100	100	100
1970	100	100	100	100	100
1971	100	100	100	100	100

TABLE XI—Continued

Point	X	Y	Point	X	Y
9-1	5673.25	632.36	10-1	5673.33	584.31
	26	35		33	30
	25	36		33	31
	26	36		33	31
2	5625.23	632.39	2	5625.28	584.37
	24	39		29	37
	23	39		28	37
	24	39		29	37
3	5577.28	632.40	3	5577.28	584.40
	28	41		29	40
	28	40		28	40
	29	41		28	41
4	5529.34	632.40	4	5529.32	584.43
	34	40		32	42
	34	40		32	43
	34	41		32	44
5	5481.39	632.37	5	5481.35	584.41
	38	36		36	41
	39	37		36	41
	38	37		36	42
6	5433.41	632.38	6	5433.38	584.41
	40	38		39	42
	40	38		39	42
	39	39		38	43
7	5385.42	632.40	7	5385.42	584.43
	42	39		42	43
	42	40		41	43
	41	40		42	44
8	5337.44	632.39	8	5337.46	584.41
	45	38		45	41
	45	38		45	41
	44	39		45	41
9	5289.50	632.41	9	5289.48	584.41
	50	41		48	40
	50	41		48	40
	50	41		48	41
10	5241.54	632.41	10	5241.47	584.37
	54	41		48	37
	54	41		48	37
	54	41		48	37
11	5193.51	632.34	11	5193.41	584.28
	51	34		41	28
	51	34		41	28
	51	34		42	27

TABLE 10. (continued)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100										
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100

TABLE XI—Continued

Point	X	Y
11-1	5673.46	536.19
	46	19
	45	20
	46	19
2	5625.36	536.32
	36	31
	35	32
	35	32
3	5577.34	536.39
	34	39
	34	39
	34	39
4	5529.34	536.43
	34	44
	35	44
	35	44
5	5481.37	536.45
	37	44
	37	45
	37	45
6	5433.40	536.47
	41	46
	40	47
	40	47
7	5385.43	536.48
	42	48
	42	48
	42	48
8	5337.45	536.43
	43	42
	45	43
	44	42
9	5289.46	536.39
	47	39
	46	39
	47	40
10	5241.43	536.32
	43	33
	43	33
	44	32
11	5193.27	536.17
	28	16
	28	16
	28	16

TABLE 1. SUMMARY OF DATA

Year	Area	Population	Area	Population
1950	10,000	10,000	10,000	10,000
1951	10,000	10,000	10,000	10,000
1952	10,000	10,000	10,000	10,000
1953	10,000	10,000	10,000	10,000
1954	10,000	10,000	10,000	10,000
1955	10,000	10,000	10,000	10,000
1956	10,000	10,000	10,000	10,000
1957	10,000	10,000	10,000	10,000
1958	10,000	10,000	10,000	10,000
1959	10,000	10,000	10,000	10,000
1960	10,000	10,000	10,000	10,000
1961	10,000	10,000	10,000	10,000
1962	10,000	10,000	10,000	10,000
1963	10,000	10,000	10,000	10,000
1964	10,000	10,000	10,000	10,000
1965	10,000	10,000	10,000	10,000
1966	10,000	10,000	10,000	10,000
1967	10,000	10,000	10,000	10,000
1968	10,000	10,000	10,000	10,000
1969	10,000	10,000	10,000	10,000
1970	10,000	10,000	10,000	10,000
1971	10,000	10,000	10,000	10,000
1972	10,000	10,000	10,000	10,000
1973	10,000	10,000	10,000	10,000
1974	10,000	10,000	10,000	10,000
1975	10,000	10,000	10,000	10,000
1976	10,000	10,000	10,000	10,000
1977	10,000	10,000	10,000	10,000
1978	10,000	10,000	10,000	10,000
1979	10,000	10,000	10,000	10,000
1980	10,000	10,000	10,000	10,000
1981	10,000	10,000	10,000	10,000
1982	10,000	10,000	10,000	10,000
1983	10,000	10,000	10,000	10,000
1984	10,000	10,000	10,000	10,000
1985	10,000	10,000	10,000	10,000
1986	10,000	10,000	10,000	10,000
1987	10,000	10,000	10,000	10,000
1988	10,000	10,000	10,000	10,000
1989	10,000	10,000	10,000	10,000
1990	10,000	10,000	10,000	10,000
1991	10,000	10,000	10,000	10,000
1992	10,000	10,000	10,000	10,000
1993	10,000	10,000	10,000	10,000
1994	10,000	10,000	10,000	10,000
1995	10,000	10,000	10,000	10,000
1996	10,000	10,000	10,000	10,000
1997	10,000	10,000	10,000	10,000
1998	10,000	10,000	10,000	10,000
1999	10,000	10,000	10,000	10,000
2000	10,000	10,000	10,000	10,000
2001	10,000	10,000	10,000	10,000
2002	10,000	10,000	10,000	10,000
2003	10,000	10,000	10,000	10,000
2004	10,000	10,000	10,000	10,000
2005	10,000	10,000	10,000	10,000
2006	10,000	10,000	10,000	10,000
2007	10,000	10,000	10,000	10,000
2008	10,000	10,000	10,000	10,000
2009	10,000	10,000	10,000	10,000
2010	10,000	10,000	10,000	10,000
2011	10,000	10,000	10,000	10,000
2012	10,000	10,000	10,000	10,000
2013	10,000	10,000	10,000	10,000
2014	10,000	10,000	10,000	10,000
2015	10,000	10,000	10,000	10,000
2016	10,000	10,000	10,000	10,000
2017	10,000	10,000	10,000	10,000
2018	10,000	10,000	10,000	10,000
2019	10,000	10,000	10,000	10,000
2020	10,000	10,000	10,000	10,000

TABLE XII

GRID 377 PLATE 49, AVERAGE DISTANCES FROM CENTER IN MM AT
MODEL SCALE

Point	X	Y	Point	X	Y
1-1	-239.996	240.030	5-1	-239.810	47.940
2	-191.905	239.912	2	-191.862	47.930
3	-143.875	239.835	3	-143.940	47.945
4	-95.882	239.805	4	-96.000	47.970
5	-47.928	239.800	5	-48.015	47.982
6	0.035	239.802	6	0.002	48.012
7	47.995	239.802	7	48.025	48.002
8	95.960	239.815	8	95.998	47.972
9	143.940	239.848	9	143.940	47.958
10	191.970	239.928	10	191.860	47.948
11	240.110	240.058	11	239.830	47.942
2-1	-239.890	191.918	6-1	-239.788	- 0.028
2	-191.860	191.845	2	-191.850	- 0.030
3	-143.860	191.820	3	-143.938	- 0.028
4	-95.900	191.815	4	-96.005	- 0.018
5	-47.962	191.825	5	-48.032	- 0.012
6	0.010	191.845	6	0	0
7	47.980	191.842	7	48.040	0.012
8	95.932	191.835	8	96.008	- 0.002
9	143.895	191.835	9	143.955	- 0.005
10	191.888	191.880	10	191.868	0.005
11	239.968	191.948	11	239.832	- 0.010
3-1	-239.835	143.9075	7-1	-239.798	- 47.990
2	-191.830	143.862	2	-191.840	- 48.005
3	-143.870	143.865	3	-143.925	- 48.015
4	-95.938	143.895	4	-95.978	- 48.025
5	-47.965	143.915	5	-48.012	- 48.052
6	0.002	143.935	6	0.008	- 48.055
7	47.990	143.935	7	48.035	- 48.030
8	95.948	143.900	8	96.020	- 48.040
9	143.900	143.878	9	143.960	- 48.015
10	191.852	143.872	10	191.882	- 47.995
11	239.888	143.912	11	239.850	- 48.005
4-1	-239.802	95.905	8-1	-239.815	- 95.955
2	-191.822	95.882	2	-191.830	- 95.955
3	-143.900	95.902	3	-143.902	- 95.975
4	-95.960	95.940	4	-95.962	- 95.995
5	-47.988	95.948	5	-47.995	- 96.035
6	0.015	95.965	6	0.018	- 96.028
7	48.015	95.975	7	48.020	- 96.002
8	95.988	95.948	8	95.988	- 95.995
9	143.935	95.920	9	143.932	- 95.958
10	191.862	95.908	10	191.868	- 95.938
11	239.862	95.900	11	239.868	- 95.962

THE TABLE

THE TABLE SHOWS THE RESULTS OF THE ANALYSIS OF THE SAMPLES OF THE SUBSTANCE, AND THE PERCENTAGE OF THE DIFFERENT ELEMENTS.

ANALYSIS	PERCENTAGE	ANALYSIS	PERCENTAGE	ANALYSIS	PERCENTAGE	ANALYSIS	PERCENTAGE
1. Carbon	72.5	2. Hydrogen	12.2	3. Nitrogen	14.8	4. Oxygen	1.5
5. Sulfur	0.5	6. Phosphorus	0.2	7. Potassium	0.1	8. Calcium	0.1
9. Magnesium	0.1	10. Iron	0.1	11. Copper	0.1	12. Zinc	0.1
13. Barium	0.1	14. Strontium	0.1	15. Lead	0.1	16. Silver	0.1
17. Gold	0.1	18. Platinum	0.1	19. Palladium	0.1	20. Rhodium	0.1
21. Iridium	0.1	22. Osmium	0.1	23. Rhenium	0.1	24. Manganese	0.1
25. Chromium	0.1	26. Vanadium	0.1	27. Niobium	0.1	28. Tantalum	0.1
29. Zirconium	0.1	30. Hafnium	0.1	31. Yttrium	0.1	32. Lanthanum	0.1
33. Cerium	0.1	34. Praseodymium	0.1	35. Neodymium	0.1	36. Promethium	0.1
37. Samarium	0.1	38. Europium	0.1	39. Gadolinium	0.1	40. Terbium	0.1
41. Dysprosium	0.1	42. Holmium	0.1	43. Erbium	0.1	44. Thulium	0.1
45. Ytterbium	0.1	46. Lutetium	0.1	47. Scandium	0.1	48. Titanium	0.1
49. Vanadium	0.1	50. Chromium	0.1	51. Manganese	0.1	52. Iron	0.1
53. Cobalt	0.1	54. Nickel	0.1	55. Copper	0.1	56. Zinc	0.1
57. Gallium	0.1	58. Germanium	0.1	59. Arsenic	0.1	60. Selenium	0.1
61. Tellurium	0.1	62. Iodine	0.1	63. Bromine	0.1	64. Chlorine	0.1
65. Fluorine	0.1	66. Neon	0.1	67. Sodium	0.1	68. Magnesium	0.1
69. Aluminum	0.1	70. Silicon	0.1	71. Phosphorus	0.1	72. Sulfur	0.1
73. Chlorine	0.1	74. Argon	0.1	75. Potassium	0.1	76. Calcium	0.1
77. Scandium	0.1	78. Titanium	0.1	79. Vanadium	0.1	80. Chromium	0.1
81. Manganese	0.1	82. Iron	0.1	83. Cobalt	0.1	84. Nickel	0.1
85. Copper	0.1	86. Zinc	0.1	87. Gallium	0.1	88. Germanium	0.1
89. Arsenic	0.1	90. Selenium	0.1	91. Tellurium	0.1	92. Iodine	0.1
93. Bromine	0.1	94. Chlorine	0.1	95. Fluorine	0.1	96. Neon	0.1
97. Sodium	0.1	98. Magnesium	0.1	99. Aluminum	0.1	100. Silicon	0.1

TABLE XII—Continued

Point	X	Y	Point	X	Y
9-1	-239.832	-143.935	11-1	-240.040	-240.108
2	-191.820	-143.908	2	-191.920	-239.970
3	-143.875	-143.902	3	-143.888	-239.885
4	- 95.922	-143.910	4	- 95.902	-239.842
5	- 47.970	-143.948	5	- 47.935	-239.842
6	0.020	-143.950	6	0.035	-239.830
7	48.002	-143.922	7	48.010	-239.818
8	95.962	-143.930	8	95.985	-239.878
9	143.918	-143.908	9	143.975	-239.900
10	191.870	-143.902	10	192.010	-239.962
11	239.898	-143.952	11	240.152	-240.130
10-1	-239.892	-191.985			
2	-191.865	-191.920			
3	-143.870	-191.890			
4	- 96.905	-191.872			
5	- 47.950	-191.905			
6	0.030	-191.895			
7	48.005	-191.870			
8	95.960	-191.890			
9	143.928	-191.895			
10	191.902	-191.920			
11	240.000	-192.005			

Table 1. Summary of the data

Year	1	2	3	4	5
1970	1000	1000	1000	1000	1000
1971	1000	1000	1000	1000	1000
1972	1000	1000	1000	1000	1000
1973	1000	1000	1000	1000	1000
1974	1000	1000	1000	1000	1000
1975	1000	1000	1000	1000	1000
1976	1000	1000	1000	1000	1000
1977	1000	1000	1000	1000	1000
1978	1000	1000	1000	1000	1000
1979	1000	1000	1000	1000	1000
1980	1000	1000	1000	1000	1000
1981	1000	1000	1000	1000	1000
1982	1000	1000	1000	1000	1000
1983	1000	1000	1000	1000	1000
1984	1000	1000	1000	1000	1000
1985	1000	1000	1000	1000	1000
1986	1000	1000	1000	1000	1000
1987	1000	1000	1000	1000	1000
1988	1000	1000	1000	1000	1000
1989	1000	1000	1000	1000	1000
1990	1000	1000	1000	1000	1000
1991	1000	1000	1000	1000	1000
1992	1000	1000	1000	1000	1000
1993	1000	1000	1000	1000	1000
1994	1000	1000	1000	1000	1000
1995	1000	1000	1000	1000	1000
1996	1000	1000	1000	1000	1000
1997	1000	1000	1000	1000	1000
1998	1000	1000	1000	1000	1000
1999	1000	1000	1000	1000	1000
2000	1000	1000	1000	1000	1000
2001	1000	1000	1000	1000	1000
2002	1000	1000	1000	1000	1000
2003	1000	1000	1000	1000	1000
2004	1000	1000	1000	1000	1000
2005	1000	1000	1000	1000	1000
2006	1000	1000	1000	1000	1000
2007	1000	1000	1000	1000	1000
2008	1000	1000	1000	1000	1000
2009	1000	1000	1000	1000	1000
2010	1000	1000	1000	1000	1000
2011	1000	1000	1000	1000	1000
2012	1000	1000	1000	1000	1000
2013	1000	1000	1000	1000	1000
2014	1000	1000	1000	1000	1000
2015	1000	1000	1000	1000	1000
2016	1000	1000	1000	1000	1000
2017	1000	1000	1000	1000	1000
2018	1000	1000	1000	1000	1000
2019	1000	1000	1000	1000	1000
2020	1000	1000	1000	1000	1000

TABLE XIII

GRID 378 PLATE 49, AVERAGE DISTANCES FROM CENTER IN MM AT
MODEL SCALE

Point	X	Y	Point	X	Y
1-1	-240.012	240.012	5-1	-239.805	47.938
2	-191.912	239.908	2	-191.860	47.930
3	-143.878	239.842	3	-143.935	47.940
4	-95.892	239.802	4	-96.002	47.965
5	-47.935	239.792	5	-48.028	47.980
6	0.018	239.795	6	-0.010	48.010
7	47.975	239.805	7	48.010	48.012
8	95.948	239.820	8	95.998	47.972
9	143.928	239.852	9	143.835	47.962
10	191.970	239.945	10	191.855	47.958
11	240.098	240.062	11	239.828	47.958
2-1	-239.900	191.915	6-1	-239.782	-0.025
2	-191.868	191.842	2	-191.848	-0.032
3	-143.875	191.822	3	-143.932	-0.022
4	-95.922	191.815	4	-96.000	-0.022
5	-47.972	191.822	5	-48.038	-0.028
6	-0.002	191.842	6	0	0
7	47.965	191.848	7	48.035	0.010
8	95.925	191.832	8	96.035	-0.018
9	143.882	191.845	9	143.945	0.005
10	191.878	191.885	10	191.868	0.010
11	239.965	191.950	11	239.832	0
3-1	-239.845	143.908	7-1	-239.782	-47.995
2	-191.838	143.862	2	-191.830	-48.008
3	-143.880	143.855	3	-143.920	-48.022
4	-95.938	143.898	4	-95.980	-48.028
5	-47.975	143.915	5	-48.010	-48.052
6	-0.005	143.922	6	0.010	-48.045
7	47.978	143.930	7	48.035	-48.038
8	95.948	143.905	8	96.022	-48.042
9	143.888	143.885	9	143.968	-48.012
10	191.840	143.895	10	191.892	-47.988
11	239.875	143.945	11	239.852	-47.995
4-1	-239.815	95.895	8-1	-239.810	-95.955
2	-191.825	95.880	2	-191.825	-95.952
3	-143.895	95.905	3	-143.900	-95.970
4	-95.962	95.935	4	-95.960	-95.992
5	-47.998	95.945	5	-47.985	-96.030
6	0	95.970	6	0.020	-96.038
7	48.008	95.975	7	48.012	-96.000
8	95.978	95.945	8	95.988	-95.990
9	143.920	95.928	9	143.935	-95.948
10	191.852	95.912	10	191.870	-95.922
11	239.850	95.922	11	239.862	-95.942

TABLE 121

WITH THE STATE OF ALABAMA—GENERAL STATE OF THE STATE

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969	2970	2971	2972	2973	2974	2975	2976	2977	2978	2979	2980	2981	2982	2983	2984	2985	2986	2987	2988	2989	2990	2991	2992	2993	2994	2995	2996	2997	2998	2999	3000	3001	3002	3003	3004	3005	3006	3007	3008	3009	3010	3011	3012	3013	3014	3015	3016	3017	3018	3019	3020	3021	3022	3023	3024	3025	3026	3027	3028	3029	3030	3031	3032	3033	3034	3035	3036	3037	3038	3039	3040	3041	3042	3043	3044	3045	3046	3047	3048	3049	3050	3051	3052	3053	3054	3055	3056	3057	3058	3059	3060	3061	3062	3063	3064	3065	3066	3067	3068	3069	3070	3071	3072	3073	3074	3075	3076	3077	3078	3079	3080	3081	3082	3083	3084	3085	3086	3087	3088	3089	3090	3091	3092	3093	3094	3095	3096	3097	3098	3099	3100	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	3112	3113	3114	3115	3116	3117	3118	3119	3120	3121	3122	3123	3124	3125	3126	3127	3128	3129	3130	3131	3132	3133	3134	3135	3136	3137	3138	3139	3140	3141	3142	3143	3144	3145	3146	3147	3148	3149	3150	3151	3152	3153	3154	3155	3156	3157	3158	3159	3160	3161	3162	3163	3164	3165	3166	3167	3168	3169

TABLE XIII--Continued

Point	X	Y	Point	X	Y
9-1	-239.822	-143.920	11-1	-240.040	-240.105
2	-191.822	-143.900	2	-191.915	-239.962
3	-143.875	-143.912	3	-143.890	-239.898
4	- 95.920	-143.910	4	- 95.900	-239.842
5	- 47.962	-143.948	5	- 47.930	-239.840
6	- 0.008	-143.942	6	0.035	-239.828
7	48.005	-143.928	7	48.012	-239.820
8	95.970	-143.930	8	95.990	-239.872
9	143.910	-143.910	9	143.975	-239.905
10	191.878	-143.890	10	192.020	-239.975
11	239.895	-143.938	11	240.155	-240.145
10-1	-239.895	-191.978			
2	-191.855	-191.915			
3	-143.868	-191.890			
4	- 95.900	-191.872			
5	- 47.950	-191.900			
6	0.025	-191.900			
7	48.000	-191.872			
8	95.965	-191.890			
9	143.928	-191.888			
10	191.915	-191.898			
11	240.008	-191.992			

[illegible]

TABLE XIV

GRID 377 PLATE 50, AVERAGE DISTANCES FROM CENTER IN MM AT
MODEL SCALE

Point	X	Y	Point	X	Y
1-1	-239.965	240.022	5-1	-239.990	47.950
2	-191.890	239.920	2	-191.840	47.940
3	-143.868	239.848	3	-143.922	47.955
4	-95.878	239.812	4	-95.998	47.988
5	-47.922	239.798	5	-48.012	48.045
6	0.035	239.805	6	0.005	48.025
7	48.002	239.858	7	48.040	48.025
8	95.962	239.822	8	96.002	47.980
9	143.952	239.905	9	143.950	47.960
10	191.985	239.972	10	191.885	47.950
11	240.122	240.065	11	239.852	47.938
2-1	-239.880	191.922	6-1	-239.775	- 0.005
2	-191.838	191.858	2	-191.840	- 0.012
3	-143.848	191.835	3	-143.930	- 0.010
4	-95.888	191.895	4	-96.000	- 0.008
5	-47.928	191.848	5	-48.038	- 0.015
6	0.020	191.868	6	0	0
7	47.990	191.855	7	48.042	0.005
8	95.950	191.838	8	96.022	- 0.010
9	143.908	191.838	9	143.958	- 0.015
10	191.908	191.868	10	191.892	- 0.010
11	239.990	191.925	11	239.850	- 0.020
3-1	-239.822	143.905	7-1	-239.788	- 47.988
2	-191.820	143.855	2	-191.820	- 47.952
3	-143.860	143.870	3	-143.910	- 48.012
4	-95.930	143.906	4	-95.975	- 48.022
5	-47.962	143.918	5	-47.995	- 48.042
6	0.018	143.935	6	0.028	- 48.038
7	47.995	143.988	7	48.072	- 48.025
8	95.960	143.910	8	96.035	- 48.032
9	143.908	143.885	9	143.975	- 48.005
10	191.862	143.875	10	191.900	- 47.998
11	239.900	143.978	11	239.875	- 48.010
4-1	-239.788	95.905	8-1	-239.810	- 95.948
2	-191.815	95.895	2	-191.828	- 95.938
3	-143.880	95.925	3	-143.908	- 95.948
4	-95.950	95.958	4	-95.962	- 95.970
5	-47.978	95.975	5	-47.998	- 96.018
6	0.020	95.990	6	0.002	- 96.020
7	48.020	95.985	7	48.015	- 95.992
8	95.988	95.942	8	95.988	- 96.002
9	143.938	95.930	9	143.945	- 95.965
10	191.875	95.902	10	191.882	- 95.952
11	239.862	95.902	11	239.882	- 95.975

2	1	1848	2	1	1848
1848-1849	1848-1849	1848	1848-1849	1848-1849	1848
1849-1850	1849-1850	1849	1849-1850	1849-1850	1849
1850-1851	1850-1851	1850	1850-1851	1850-1851	1850
1851-1852	1851-1852	1851	1851-1852	1851-1852	1851
1852-1853	1852-1853	1852	1852-1853	1852-1853	1852
1853-1854	1853-1854	1853	1853-1854	1853-1854	1853
1854-1855	1854-1855	1854	1854-1855	1854-1855	1854
1855-1856	1855-1856	1855	1855-1856	1855-1856	1855
1856-1857	1856-1857	1856	1856-1857	1856-1857	1856
1857-1858	1857-1858	1857	1857-1858	1857-1858	1857
1858-1859	1858-1859	1858	1858-1859	1858-1859	1858
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1860-1861	1860-1861	1860	1860-1861	1860-1861	1860
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1862-1863	1862-1863	1862	1862-1863	1862-1863	1862
1863-1864	1863-1864	1863	1863-1864	1863-1864	1863
1864-1865	1864-1865	1864	1864-1865	1864-1865	1864
1865-1866	1865-1866	1865	1865-1866	1865-1866	1865
1866-1867	1866-1867	1866	1866-1867	1866-1867	1866
1867-1868	1867-1868	1867	1867-1868	1867-1868	1867
1868-1869	1868-1869	1868	1868-1869	1868-1869	1868
1869-1870	1869-1870	1869	1869-1870	1869-1870	1869
1870-1871	1870-1871	1870	1870-1871	1870-1871	1870
1871-1872	1871-1872	1871	1871-1872	1871-1872	1871
1872-1873	1872-1873	1872	1872-1873	1872-1873	1872
1873-1874	1873-1874	1873	1873-1874	1873-1874	1873
1874-1875	1874-1875	1874	1874-1875	1874-1875	1874
1875-1876	1875-1876	1875	1875-1876	1875-1876	1875
1876-1877	1876-1877	1876	1876-1877	1876-1877	1876
1877-1878	1877-1878	1877	1877-1878	1877-1878	1877
1878-1879	1878-1879	1878	1878-1879	1878-1879	1878
1879-1880	1879-1880	1879	1879-1880	1879-1880	1879
1880-1881	1880-1881	1880	1880-1881	1880-1881	1880
1881-1882	1881-1882	1881	1881-1882	1881-1882	1881
1882-1883	1882-1883	1882	1882-1883	1882-1883	1882
1883-1884	1883-1884	1883	1883-1884	1883-1884	1883
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1892-1893	1892-1893	1892	1892-1893	1892-1893	1892
1893-1894	1893-1894	1893	1893-1894	1893-1894	1893
1894-1895	1894-1895	1894	1894-1895	1894-1895	1894
1895-1896	1895-1896	1895	1895-1896	1895-1896	1895
1896-1897	1896-1897	1896	1896-1897	1896-1897	1896
1897-1898	1897-1898	1897	1897-1898	1897-1898	1897
1898-1899	1898-1899	1898	1898-1899	1898-1899	1898

TABLE XIV--Continued

Point	X	Y	Point	X	Y
9-1	-239.830	-143.932	11-1	-240.042	-240.090
2	-191.822	-143.905	2	-191.928	-239.958
3	-143.858	-143.900	3	-143.890	-239.908
4	-95.912	-143.908	4	-95.908	-239.832
5	-47.955	-143.950	5	-47.945	-239.842
6	0.028	-143.945	6	0.030	-239.835
7	48.028	-143.915	7	48.012	-239.828
8	95.982	-143.930	8	95.988	-239.872
9	143.940	-143.908	9	143.972	-239.910
10	191.895	-143.905	10	192.002	-239.928
11	239.920	-143.955	11	240.155	-240.152
10-1	-238.892	-191.980			
2	-191.855	-191.915			
3	-143.860	-191.895			
4	-95.888	-191.865			
5	-47.930	-191.900			
6	0.038	-191.900			
7	48.010	-191.885			
8	95.975	-191.902			
9	143.952	-191.910			
10	191.955	-191.940			
11	240.022	-192.025			

TABLE XV

GRID 378 PLATE 50, AVERAGE DISTANCES FROM CENTER IN MM AT
MODEL SCALE

Point	X	Y	Point	X	Y
1-1	-239.978	239.970	5-1	-239.772	47.918
2	-191.895	239.882	2	-191.830	47.930
3	-143.870	239.810	3	-143.920	47.948
4	-95.890	239.780	4	-95.990	47.990
5	-47.938	239.775	5	-48.008	48.005
6	0.020	239.795	6	0.020	48.030
7	47.938	239.795	7	48.038	48.032
8	95.940	239.805	8	96.020	48.000
9	143.925	239.845	9	143.958	47.980
10	191.960	239.912	10	191.885	47.965
11	240.092	240.045	11	239.860	47.935
2-1	-239.880	191.890	6-1	-239.762	- 0.038
2	-191.828	191.822	2	-191.825	- 0.030
3	-143.842	191.812	3	-143.922	- 0.018
4	-96.892	191.832	4	-95.985	0.002
5	-47.940	191.838	5	-48.020	- 0.010
6	0.010	191.858	6	0	0
7	47.978	191.850	7	48.050	0.015
8	195.940	191.835	8	96.038	0.005
9	143.895	191.835	9	143.972	0.008
10	191.900	191.865	10	191.898	0.008
11	239.975	191.925	11	239.865	- 0.010
3-1	-239.802	143.870	7-1	-239.755	- 48.012
2	-191.805	143.848	2	-191.795	- 48.012
3	-143.855	143.860	3	-143.888	- 48.012
4	-95.922	143.908	4	-95.948	- 48.020
5	-47.962	143.922	5	-47.988	- 48.040
6	0.025	143.940	6	0.045	- 48.035
7	47.995	143.948	7	48.075	- 48.020
8	95.958	143.918	8	96.055	- 48.010
9	143.902	143.890	9	143.980	- 47.985
10	191.858	143.878	10	191.915	- 47.975
11	239.888	143.912	11	239.885	- 48.005
4-1	-239.775	95.880	8-1	-239.775	- 95.965
2	-191.802	95.888	2	-191.808	- 95.960
3	-143.888	95.912	3	-143.868	- 95.960
4	-95.940	95.962	4	-95.935	- 95.972
5	-47.972	95.985	5	-47.968	- 96.005
6	0.020	96.008	6	0.030	- 96.015
7	48.020	96.005	7	48.035	- 95.982
8	95.998	95.962	8	96.008	- 95.995
9	143.945	95.942	9	143.958	- 95.960
10	192.875	95.920	10	191.898	- 95.940
11	239.860	95.908	11	239.896	- 95.972

[illegible]

TABLE XV--Continued

Point	X	Y	Point	X	Y
9-1	-239.802	-143.962	11-1	-240.005	-240.122
2	-191.782	-143.930	2	-191.902	-240.002
3	-143.830	-143.915	3	-143.888	-239.930
4	-95.888	-143.918	4	-95.892	-239.882
5	-47.932	-143.952	5	-47.918	-239.872
6	0.052	-143.938	6	0.050	-239.858
7	48.035	-143.922	7	48.030	-239.840
8	96.008	-143.935	8	96.010	-239.895
9	143.952	-143.910	9	143.988	-239.928
10	191.912	-143.910	10	192.020	-239.995
11	239.942	-143.980	11	240.175	-240.158
10-1	-239.878	-192.012			
2	-191.832	-191.950			
3	-143.830	-191.918			
4	-95.878	-191.890			
5	-47.905	-191.908			
6	0.068	-191.900			
7	48.035	-191.888			
8	96.000	-191.910			
9	143.972	-191.915			
10	191.975	-191.950			
11	240.040	-192.048			

TABLE XVI

GRID 377 PLATE 49, DISTORTION IN MICRONS AT MODEL SCALE

Point	Radial	Tang.	Point	Radial	Tang.	Point	Radial	Tang.
1-1	20	23	5-1	-198	-22	9-1	- 91	20
2	-128	18	2	-151	-35	2	-198	-36
3	-205	22	3	- 74	-33	3	-158	-19
4	-225	37	4	- 13	-27	4	-118	-15
5	-210	30	5	- 2	-23	5	- 59	-13
6	-192	35	6	12	2	6	- 50	-21
7	-189	32	7	19	17	7	- 73	-26
8	-186	31	8	- 13	25	8	- 80	- 6
9	-189	43	9	- 70	21	9	-123	- 7
10	- 74	22	10	-148	16	10	-162	0
11	+118	37	11	-178	24	11	-111	12
2-1	-136	5	6-1	-212	-28	10-1	- 94	-56
2	-207	-11	2	-150	-30	2	-152	-39
3	-208	19	3	- 62	-28	3	-166	-38
4	-201	55	4	5	-18	4	-157	-28
5	-178	- 6	5	- 32	-12	5	-107	- 3
6	-155	10	6	0	0	6	-105	-30
7	-158	19	7	40	-12	7	-125	-25
8	-178	13	8	- 8	2	8	-116	-12
9	-195	15	9	- 45	5	9	-127	- 5
10	-164	6	10	-132	10	10	-125	12
11	- 58	21	11	-168	10	11	4	4
3-1	-187	6	7-1	-199	-30	11-1	105	-47
2	-219	- 8	2	-153	-44	2	- 73	-44
3	-188	- 4	3	- 66	-38	3	-156	-37
4	-122	- 7	4	- 8	-33	4	-183	-33
5	- 76	7	5	46	-28	5	- 78	-39
6	- 65	2	6	55	- 8	6	-170	-35
7	- 65	11	7	46	- 4	7	-176	-44
8	-112	12	8	36	27	8	-118	-31
9	-156	15	9	33	26	9	- 98	-30
10	-195	13	10	-115	24	10	35	15
11	-141	18	11	-146	35	11	198	-15
4-1	-219	-15	8-1	-188	-17			
2	-212	-26	2	-172	-36			
3	-137	-26	3	- 95	-34			
4	- 71	-14	4	- 30	-23			
5	- 52	-12	5	29	-19			
6	- 25	15	6	28	-18			
7	- 17	25	7	10	-16			
8	-45	17	8	- 12	6			
9	- 99	30	9	- 79	3			
10	- 75	66	10	-146	26			
11	-166	42	11	- 44	-24			

TABLE XVII

GRID 378 PLATE 49, DISTORTION IN MICRONS AT MODEL SCALE

Point	Radial	Tang.	Point	Radial	Tang.	Point	Radial	Tang.
1-1	17	0	5-1	-203	-23	9-1	-193	-24
2	-127	12	2	-153	-35	2	-202	-27
3	-197	23	3	-80	-38	3	-150	-26
4	-223	26	4	-14	-33	4	-119	-17
5	-217	23	5	5	-32	5	-65	-3
6	-205	18	6	10	-10	6	-58	8
7	-196	14	7	24	-7	7	-67	-26
8	-187	19	8	-14	25	8	-75	-14
9	-164	14	9	-169	-12	9	-128	0
10	-62	12	10	-151	6	10	-164	-15
11	113	25	11	-177	8	11	-122	2
2-1	-130	-4	6-1	-218	-25	10-1	-96	-49
2	-204	-19	2	-152	-32	2	-162	-42
3	-217	-8	3	-60	-22	3	-167	-40
4	-200	-13	4	0	-22	4	-198	-32
5	-180	-16	5	38	-28	5	-109	-24
6	-158	-2	6	0	0	6	-100	-25
7	-156	4	7	35	-10	7	-134	-32
8	-183	8	8	35	18	8	-113	-18
9	-195	-2	9	-55	-5	9	-132	-10
10	-168	-5	10	-132	-10	10	-132	-12
11	-59	17	11	-168	0	11	-6	-10
3-1	-180	2	7-1	-216	-38	11-1	102	-44
2	-212	-13	2	-163	-48	2	-83	-43
3	-187	-18	3	-69	-46	3	-144	-42
4	-105	5	4	-11	-32	4	-184	-34
5	-89	-4	5	32	-40	5	-171	-37
6	-78	-5	6	45	-10	6	-172	-35
7	-74	2	7	51	2	7	-175	-47
8	-108	9	8	38	28	8	-123	-38
9	-161	2	9	-25	12	9	-94	-27
10	-190	-13	10	-107	15	10	-8	-32
11	-136	-18	11	-119	24	11	212	-7
4-1	-212	-28	8-1	-100	8			
2	-211	-30	2	-177	-36			
3	-140	-20	3	-100	-30			
4	-72	-20	4	-34	-23			
5	-50	-23	5	20	-26			
6	-30	0	6	38	-20			
7	-20	18	7	6	-11			
8	-55	24	8	-16	2			
9	-104	29	9	-82	-8			
10	-172	12	10	-151	-12			
11	-168	17	11	-150	-3			

TABLE XVIII

GRID 377 PLATE 50, DISTORTION IN MICRONS AT MODEL SCALE

Point	Radial	Tang.	Point	Radial	Tang.	Point	Radial	Tang.
1-1	- 9	40	5-1	-215	- 9	9-1	-180	-30
2	-132	36	2	-170	-20	2	-199	-32
3	-199	35	3	- 88	-13	3	-171	-30
4	-223	42	4	- 9	-10	4	-126	-22
5	-213	36	5	- 40	24	5	- 61	-27
6	-195	35	6	25	5	6	- 55	-28
7	-139	30	7	44	12	7	- 72	-53
8	-160	31	8	- 7	19	8	- 68	-24
9	-107	6	9	- 60	23	9	-107	-23
10	76	- 7	10	-124	21	10	-142	-13
11	132	40	11	-157	32	11	- 91	4
2-1	-142	14	6-1	-225	- 5	10-1	- 96	- 52
2	-214	14	2	-160	-12	2	-163	-43
3	-222	22	3	- 70	-10	3	-168	-50
4	-144	53	4	0	8	4	-171	-40
5	-165	33	5	38	-15	5	-113	-44
6	-132	20	6	0	0	6	-100	-38
7	-143	26	7	42	- 5	7	-109	-37
8	-167	28	8	22	10	8	- 96	-22
9	-172	40	9	- 42	15	9	-100	-16
10	-145	42	10	-108	10	10	- 74	-11
11	- 55	52	11	-150	20	11	34	7
3-1	-200	10	7-1	-209	-30	11-1	94	-33
2	-231	- 7	2	-186	3	2	- 78	-30
3	-190	8	3	- 62	-40	3	-127	-53
4	-116	6	4	- 12	-30	4	-187	-14
5	- 95	39	5	25	-34	5	-166	-24
6	- 65	18	6	30	-28	6	-165	-30
7	-14	0	7	62	-46	7	-166	-46
8	- 97	17	8	46	12	8	-123	-36
9	-144	37	9	- 22	13	9	- 91	-22
10	-136	16	10	- 97	23	10	- 56	-46
11	- 97	-33	11	-120	34	11	217	- 3
4-1	-139	-47	8-1	-195	-21			
2	-220	- 7	2	-181	-22			
3	-140	5	3	-105	- 8			
4	- 64	6	4	- 48	- 6			
5	- 32	9	5	14	- 9			
6	- 10	20	6	20	- 2			
7	- 5	25	7	0	-16			
8	- 56	16	8	- 6	10			
9	- 90	14	9	- 65	2			
10	-153	26	10	-126	10			
11	-172	30	11	-118	21			

TABLE XIX

GRID 378 PLATE 50, DISTORTION IN MICRONS AT MODEL SCALE

Point	Radial	Tang.	Point	Radial	Tang.	Point	Radial	Tang.
1-1	- 36	6	5-1	-240	-36	9-1	-206	-42
2	-157	8	2	-182	-27	2	-216	-75
3	-229	14	3	- 92	-24	3	-180	-60
4	-245	20	4	- 13	- 5	4	-130	-48
5	-232	16	5	9	- 3	5	- 66	-50
6	-205	20	6	30	20	6	- 62	-52
7	-213	22	7	38	4	7	- 63	-57
8	-203	16	8	18	9	8	- 34	-57
9	-172	15	9	- 46	7	9	- 97	-30
10	- 94	24	10	-120	7	10	-124	-19
11	82	20	11	-350	37	11	- 60	16
2-1	-163	11	6-1	-238	-38	10-1	-102	-66
2	-247	18	2	-175	-30	2	-170	-72
3	-244	14	3	- 78	-18	3	-168	-87
4	-198	21	4	- 15	2	4	-153	-60
5	-171	18	5	20	-10	5	-112	-70
6	-142	10	6	0	0	6	-100	-32
7	-150	15	7	50	-15	7	-100	-60
8	-174	20	8	38	- 5	8	- 80	-40
9	-196	15	9	-28	- 28	9	- 84	-29
10	-166	24	10	-102	- 8	10	- 80	-40
11	- 66	43	11	-135	10	11	- 60	12
3-1	-225	-10	7-1	-237	-60	11-1	90	-80
2	-242	- 7	2	-195	-62	2	- 59	-78
3	-202	4	3	-102	-46	3	-118	-60
4	-125	22	4	- 37	-41	4	-150	-46
5	- 86	12	5	- 6	-12	5	-141	-46
6	-60	25	6	35	-45	6	-142	-50
7	- 51	12	7	67	-38	7	-152	-60
8	- 92	11	8	54	-16	8	- 93	-46
9	-140	15	9	-24	- 8	9	- 68	-26
10	-187	12	10	- 88	- 4	10	8	-19
11	-141	17	11	-111	28	11	237	-12
4-1	-253	-38	8-1	-222	-51			
2	-226	-12	2	-189	-51			
3	-141	17	3	-132	-40			
4	- 68	16	4	-72	-20			
5	- 26	19	5	- 9	-30			
6	8	20	6	15	-30			
7	14	16	7	0	-38			
8	- 28	26	8	49	-57			
9	- 77	18	9	- 57	-10			
10	-148	16	10	-117	- 7			
11	-164	34	11	-104	12			

TABLE XX

PLATE 49, AVERAGE DISTORTION IN MICRONS AT PHOTO SCALE

Point	Radial	Tang.	Point	Radial	Tang.	Point	Radial	Tang.
1-1	8	5	5-1	-34	-9	9-1	-59	-1
2	-53	6	2	-64	-15	2	-83	-13
3	-84	9	3	-32	-15	3	-64	-9
4	-93	13	4	-6	-13	4	-49	-7
5	-89	11	5	1	-11	5	-26	-3
6	-84	11	6	5	-2	6	-23	-3
7	-80	10	7	9	2	7	-29	-11
8	-78	10	8	-6	10	8	-32	-4
9	-74	12	9	-50	2	9	-52	-2
10	-28	7	10	-62	5	10	-63	-3
11	48	13	11	-74	7	11	-49	3
2-1	-55	0	6-1	-90	-11	10-1	-40	-22
2	-86	6	2	-63	-13	2	-65	-17
3	-89	2	3	-27	-10	3	-69	-16
4	-84	9	4	1	-8	4	-74	-13
5	-75	-5	5	1	-8	5	-45	-6
6	-65	2	6	0	0	6	-43	-11
7	-65	5	7	16	-5	7	-54	-12
8	-75	4	8	-13	4	8	-48	-6
9	-81	3	9	-21	0	9	-54	-3
10	-69	0	10	-55	0	10	-54	0
11	-24	8	11	-70	2	11	0	-1
3-1	-76	2	7-1	-86	-14	11-1	43	-19
2	-90	-4	2	-66	-19	2	-33	-18
3	-78	-5	3	-28	-18	3	-63	-16
4	-47	0	4	-4	-14	4	-76	-14
5	-34	1	5	16	-14	5	-52	-16
6	-30	-1	6	21	0	6	-71	-15
7	-29	3	7	20	6	7	-73	-19
8	-46	4	8	15	11	8	-50	-14
9	-66	3	9	1	8	9	-40	-12
10	-80	0	10	-46	8	10	6	-4
11	-58	0	11	-55	12	11	85	-5
4-1	-90	-9	8-1	-60	-2			
2	-88	-12	2	-73	-15			
3	-58	-10	3	-41	-13			
4	-30	-7	4	-13	-10			
5	-21	-7	5	10	-10			
6	-11	3	6	14	-8			
7	-8	9	7	3	-6			
8	-21	9	8	-8	2			
9	-42	12	9	-34	-1			
10	-51	16	10	-62	3			
11	-70	12	11	-40	-6			

TABLE XXI

PLATE 50, AVERAGE DISTORTION IN MICRONS AT PHOTO SCALE

Point	Radial	Tang.	Point	Radial	Tang.	Point	Radial	Tang.
1-1	-9	10	5-1	-93	-10	9-1	-80	-15
2	-60	9	2	-73	-10	2	-87	-22
3	-89	10	3	-38	-8	3	-73	-19
4	-98	13	4	-5	-3	4	-53	-15
5	-93	11	5	-6	4	5	-26	-16
6	-83	11	6	11	5	6	-24	-17
7	-73	11	7	17	3	7	-28	-23
8	-80	10	8	2	6	8	-21	-17
9	-58	5	9	-22	6	9	-43	-11
10	-4	4	10	-51	6	10	-41	-25
11	45	13	11	-64	14	11	-32	4
2-1	-64	5	6-1	-97	-9	10-1	-41	-25
2	-96	7	2	-70	-9	2	-69	-24
3	-97	8	3	-33	-6	3	-70	-29
4	-71	15	4	-3	2	4	-68	-21
5	-70	11	5	12	-5	5	-47	-24
6	-57	6	6	0	0	6	-42	-15
7	-61	9	7	19	-4	7	-44	-20
8	-71	10	8	13	1	8	-37	-13
9	-77	11	9	-15	2	9	-38	-9
10	-65	14	10	-44	0	10	-32	-11
11	-25	20	11	-59	6	11	20	4
3-1	-89	0	7-1	-93	-19	11-1	38	-24
2	-99	-3	2	-79	-12	2	-29	-23
3	-82	3	3	-38	-18	3	-51	-24
4	-50	6	4	-10	-15	4	-70	-13
5	-38	11	5	4	-10	5	-64	-15
6	-26	9	6	15	-15	6	-64	-17
7	-14	3	7	31	-18	7	-66	-22
8	-39	6	8	21	-1	8	-45	-17
9	-59	11	9	-10	1	9	-33	-10
10	-78	6	10	-39	4	10	-10	-14
11	-50	-3	11	-48	13	11	95	-3
4-1	-82	-18	8-1	-87	-15			
2	-93	-4	2	-77	-15			
3	-59	5	3	-49	-10			
4	-28	5	4	-25	-5			
5	-12	6	5	1	-8			
6	0	8	6	7	-7			
7	2	9	7	0	-11			
8	-18	9	8	9	-10			
9	-35	7	9	-25	-2			
10	-63	9	10	-51	1			
11	-70	13	11	-46	7			

TABLE XXII

PLATE 49, CORRECTED TANGENTIAL
DISTORTION IN MICRONS

Pt. Dist.	Pt. Dist.	Pt. Dist.
1-1	12	5-1 - 4
2	12	2 -11
3	15	3 -12
4	18	4 -11
5	16	5 -10
6	16	6 - 1
7	15	7 3
8	15	8 12
9	18	9 5
10	13	10 9
11	20	11 12
2-1	6	6-1 - 6
2	12	2 - 9
3	7	3 - 7
4	13	4 - 6
5	- 1	5 - 7
6	6	6 0
7	9	7 - 4
8	8	8 6
9	8	9 3
10	6	10 4
11	14	11 7
3-1	8	7-1 - 9
2	1	2 -15
3	- 1	3 -15
4	4	4 -12
5	4	5 -13
6	2	6 1
7	6	7 7
8	8	8 13
9	7	9 11
10	5	10 12
11	6	11 17
4-1	- 4	8-1 3
2	- 8	2 -11
3	- 6	3 - 9
4	- 4	4 - 7
5	- 5	5 - 8
6	5	6 - 6
7	11	7 - 4
8	12	8 5
9	16	9 3
10	20	10 7
11	17	11 - 1

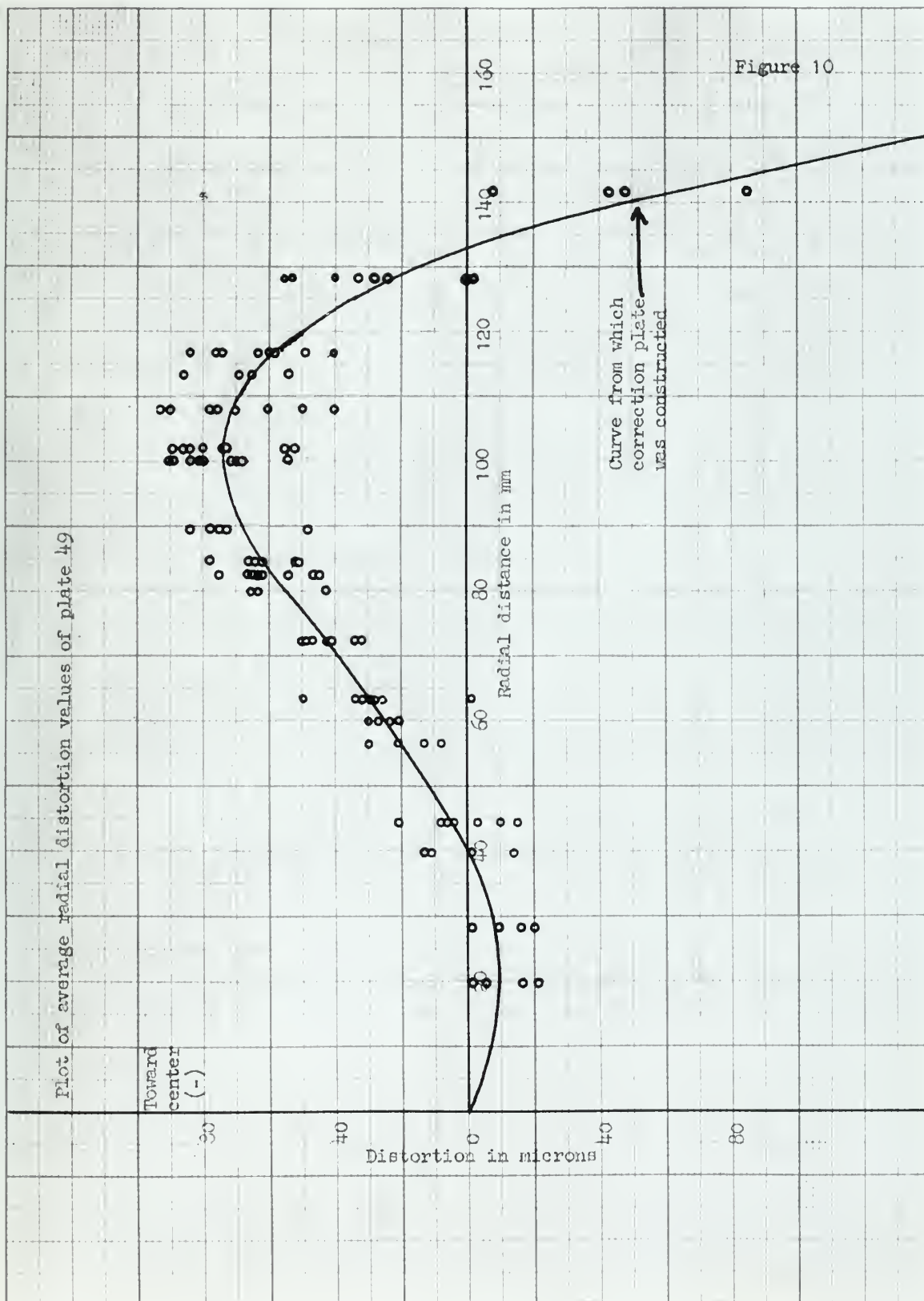
TABLE XXIII

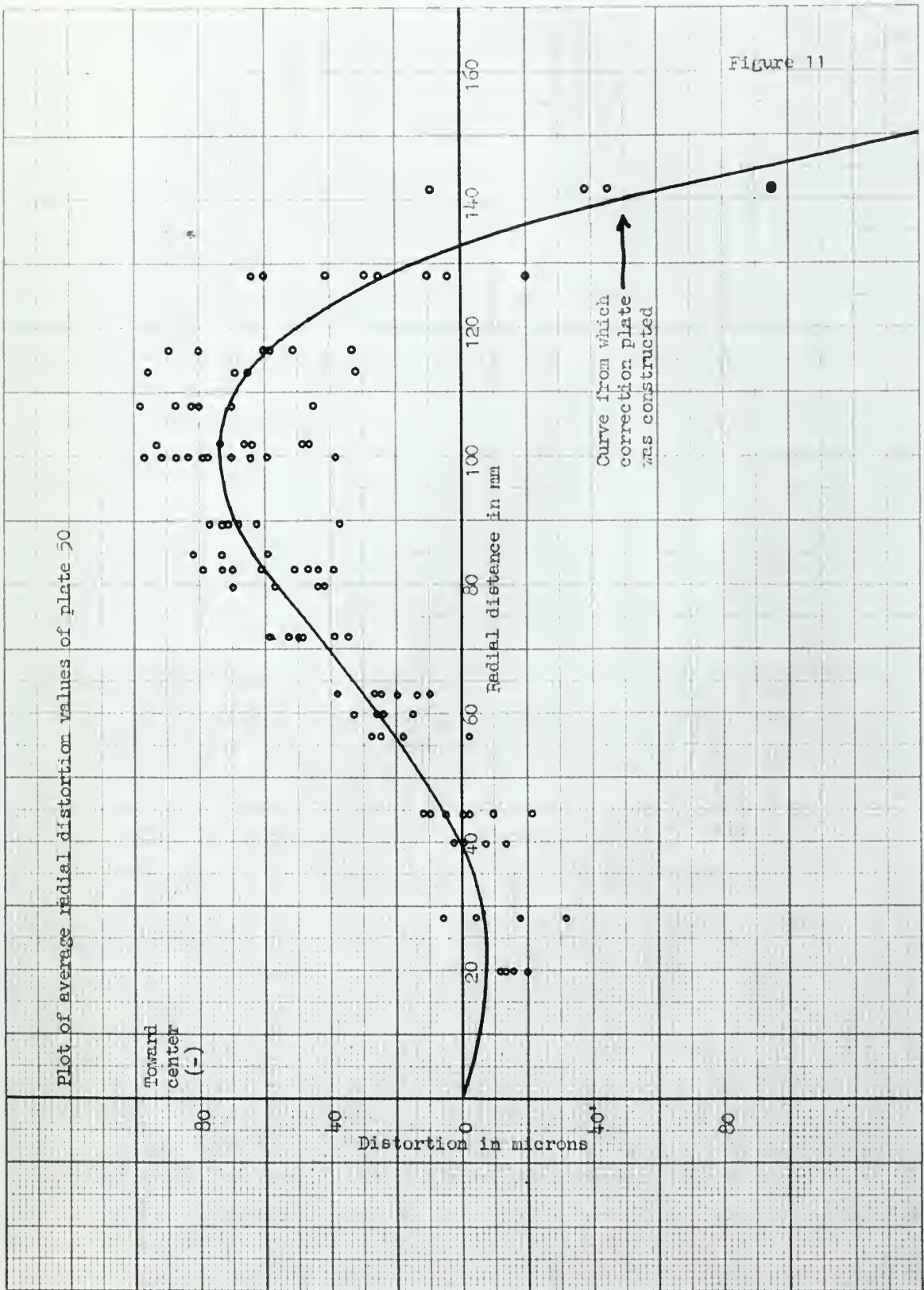
PLATE 50, CORRECTED TANGENTIAL
DISTORTION IN MICRONS

Pt. Dist.	Pt. Dist.	Pt. Dist.
1-1	16	5-1 - 6
2	14	2 - 7
3	15	3 - 5
4	17	4 - 1
5	15	5 5
6	15	6 6
7	15	7 4
8	14	8 8
9	10	9 9
10	9	10 9
11	19	11 18
2-1	10	6-1 - 5
2	12	2 - 6
3	12	3 - 3
4	19	4 4
5	14	5 - 4
6	9	6 0
7	12	7 - 3
8	14	8 3
9	15	9 5
10	19	10 3
11	25	11 10
3-1	5	7-1 -15
2	1	2 - 9
3	7	3 -15
4	9	4 -13
5	14	5 - 9
6	12	6 -14
7	6	7 -17
8	9	8 1
9	15	9 4
10	10	10 7
11	2	11 17
4-1	-14	8-1 -11
2	0	2 -11
3	8	3 - 7
4	7	4 - 3
5	8	5 - 6
6	10	6 - 5
7	11	7 - 9
8	11	8 - 8
9	10	9 1
10	13	10 5
11	17	11 11

1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 26

The above is a list of the names of the persons who have been
 named in the above list of names. The names are given in the
 order in which they appear in the list of names. The names are
 given in the order in which they appear in the list of names.





CONSTRUCTION OF COORDINATE ERROR CURVES

Using the metrogon correction plate curve, as specified for construction, as the reference, the curves of elevation error were computed and tabulated in Table VII. Using these values and the equations for p_y , dX'' and e_0 derived in Chapter II, values were computed for points in the model sufficient to construct error curves. Lens 13 is the worst of the 25 lenses in point of view of resultant elevation errors and lens 18 the best. Table XXIV contains these computations which were done for the upper half of the model only due to the symmetry about the X axis. Figures 12 through 20 are the constructed curves. These curves are computed on the basis of an assumed elevation of 4,000 meters above the terrain just as all examples throughout the thesis have been.

In order to provide a more realistic picture of the anticipated errors, the elements of mathematical relative orientation were computed for a dependent pair orientation procedure using the following formulae:

$$d\phi_2 = \frac{3183h}{b^2}(p_3 - p_4 - p_5 + p_6)$$

$$d\omega_2 = \frac{1591h}{d^2}(-2p_1 - 2p_2 + p_3 + p_4 + p_5 + p_6)$$

$$d\kappa_2 = \frac{2122}{b}(p_1 - p_2 + p_3 - p_4 + p_5 - p_6)$$

$$dbs_2 = \frac{h}{2d}(p_6 - p_4)$$

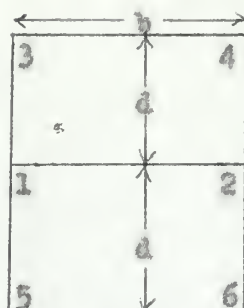
There is a large number of cases in which the same word is used in different contexts, and the meaning is different. For example, the word "cat" can refer to a feline animal, or to a type of fish, or to a type of plant. In each case, the meaning is determined by the context in which the word is used.

[illegible]

Where: Quantities are in centesimal minutes and mm.

p = parallax at given point in model

h = projector to model distance



Model

Points 3, 4, 5, 6 are approximately 1 cm from the respective upper and lower edges of the photo.

Points 1 and 2 are approximately the nadir points.

<u>Lens</u>	<u>P₁</u>	<u>P₂</u>	<u>P₃</u>	<u>P₄</u>	<u>P₅</u>	<u>P₆</u>
13	0	0	-.037	.037	.037	-.037 mm
Ave.	0	0	.0025	-.0025	-.0025	.0025
18	0	0	.0042	-.0042	-.0042	.0042

<u>Lens</u>	<u>dφ₂</u>	<u>dω₂</u>	<u>dκ₂</u>	<u>dbz₂</u>
13	-7.88°	0	0	-.0564 mm
Ave.	.533	0	0	.0038
18	.895	0	0	.0064

These elements were then introduced into the following equation to solve for the change in e_2 , the elevation error of the right projector, caused by relative orientation:

$$dh = \left[\frac{h^2}{b} + \frac{(X-b)^2}{b} \right] d\phi_2 - \frac{(X-b)Y}{b} d\omega_2 - \frac{hY}{b} d\kappa_2 + \frac{(X-b)}{b} dbz_2$$

and the internal dimensions of the rectangular vessel
 were as follows: length of cylinder = 3
 diameter of cylinder = 1

Assuming that the vessel was
 empty at the time the
 vessel was placed in the
 water, the water level



Diagram

	1	2	3	4	5	6	7
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000

These elements were then determined by the following
 equation for the water level in the vessel when it
 was placed in the water, assuming the vessel was empty

$$V = \frac{1}{2} \pi r^2 h = \frac{1}{2} \pi \left(\frac{1}{2} \right)^2 h = \frac{1}{8} \pi h$$

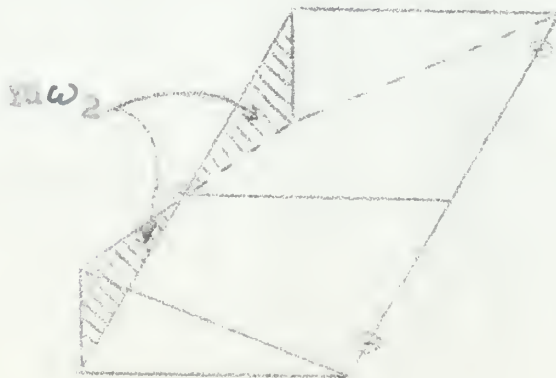
As can be seen from the above table of elements of orientation, all elements except $d\phi_2$ and dbz_2 are zero due to the symmetry of the parallax resulting from the model composed of two vertical photos. The dbz_2 element is retained in the computations even though it could be corrected for in the absolute orientation, as it causes a straight line tilt of the model about the Y axis as shown below:



The h^2/b part of the $d\phi_2$ coefficient is a constant elevation change, thus could be compensated in absolute orientation, and the $(X-b)^2/b$ is the variable as shown below:



The absolute orientation will be carried out using three points as near as possible to the points circled in the above diagram in order to compensate in the absolute orientation, as near as possible, for the error in $d\phi_2$ brought about by parallax caused by uncompensated distortion in the camera lens. Also this scheme of points will avoid correcting for any error in $d\omega_2$ caused by distortion parallax, as can be seen from the following diagram of elevation error caused by $d\omega_2$:

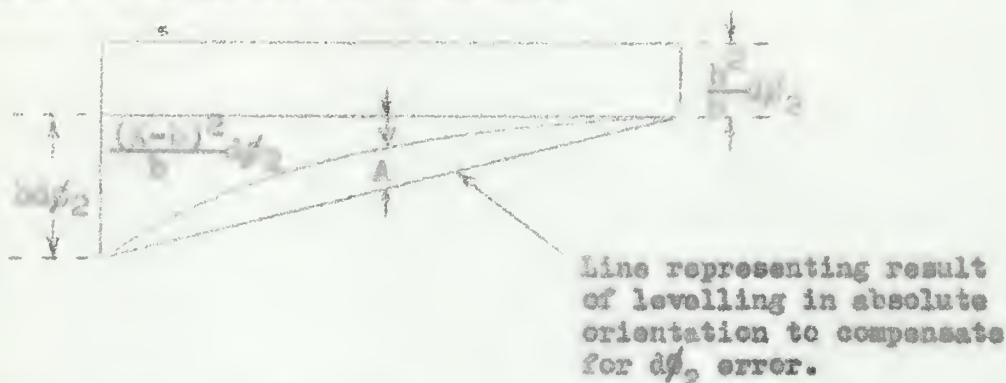




The diagram illustrates the principle of the lever, which is a simple machine that can be used to lift or move a load. It consists of a rigid beam that pivots on a point called the fulcrum. The effort is applied at one end of the beam, and the load is applied at the other end. The distance from the fulcrum to the effort is called the effort arm, and the distance from the fulcrum to the load is called the load arm. The principle of the lever states that the product of the effort and the effort arm is equal to the product of the load and the load arm. This can be expressed mathematically as $E \times E_a = L \times L_a$, where E is the effort, E_a is the effort arm, L is the load, and L_a is the load arm.



The effect of the warping caused by a $d\phi_2$ error can be seen in Figures 27 through 29. The elevation errors along the X-axis form a curve with a definite change of slope as can be seen in a diagram of the theoretical situation.



As an indication of the effect of the approximation of $d\phi_2$ in absolute orientation, the magnitude of A, the maximum point of separation, is computed for each of the three lenses:

<u>Lens</u>	<u>A at ground scale in meters</u>	<u>Error as a fraction of flying height</u>
13	0.742	1:5400
Ave.	0.050	1:90000
18	0.084	1:47600

Measurement of cross-section graphs through the X-axis of Figures 27 through 29 yields values of A greater than in the above table but approximately equal to A plus the result of dbz_2 at that point. As can be seen from the above table of values, this approximation, in all but the worst lenses, will not introduce errors anywhere near the errors caused by the uncompensated distortion. Measurement of a cross-section through the X-axis of Figure 32, the elevation errors of the actual photography, yielded this curve with a value for A of approximately twice that found for lens 18.

1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal. If there is a significant difference, a problem is identified.

At the same time, it is important to note that the results of this study are preliminary and need to be confirmed by larger, more rigorous studies. The study also has some limitations, such as the relatively small sample size and the lack of control over the environment. However, the study provides a valuable insight into the relationship between the two variables and suggests a potential mechanism for the effect.

Material	Quantity	Unit Price	Total
Concrete	1000	1.50	1500
Rebar	500	2.00	1000
Formwork	200	3.00	600
Paint	100	4.00	400
Other	50	5.00	250
Total			3750

1. The first of these is the fact that the majority of the population of the United States is now living in urban areas. This is a result of the process of urbanization, which has been going on since the beginning of the 20th century. The process of urbanization is the movement of people from rural areas to urban areas. This is a result of the fact that urban areas offer more opportunities for employment and education than rural areas do. The process of urbanization has led to the growth of large cities and the decline of small towns and villages. This has had a major impact on the way of life in the United States. The majority of the population now lives in cities, and this has led to a number of changes in the way of life. For example, the majority of the population now lives in multi-story apartment buildings or houses, and this has led to a change in the way of life. The majority of the population now lives in cities, and this has led to a number of changes in the way of life. For example, the majority of the population now lives in multi-story apartment buildings or houses, and this has led to a change in the way of life.

The computations of δh appear in Table XXVI. The curves of the resultant errors appear in Figures 21 through 29. After this false orientation, which has destroyed the true spatial relationship, the errors depicted in Figures 21 through 29 would represent, approximately, what would be observed in models formed with these lenses, except that the model formed with lens 13 would require extensive adjustment to correct the large amount of y -parallax present. The average lens is probably representative of most metrogon lenses.

As a comparison of the data plotted in Figures 12 through 20 and Figures 21 through 29, the following table of maximum errors is presented, in which the errors are stated as fractional parts of the aircraft elevation:

	<u>Elevation Errors</u>	<u>X-direction Errors</u>
True spatial model Fig. 12-20		
Lens 13	1:1300	1:8000
Average lens	1:5000	1:27000
Lens 18	1:20000	1:65000
Oriented model Fig. 21-29		
Lens 13	1:400	1:4000
Average lens	1:2670	1:16000
Lens 18	1:1600	1:10000

The best elevation accuracy attainable would be approximately three halves that of a second order plotter and one half that in a first order instrument. The relative accuracy of using the above metrogon photography in a first order instrument to that in a second order instrument would be approximately

$$\sqrt{1.5^2 + 3^2} : \sqrt{1.5^2 + 1^2} \text{ or } 1.88:1.$$

The purpose of the present study is to determine the effect of the amount of water on the growth of the plant. The amount of water was varied from 10 to 20 ml. The plants were grown in a controlled environment. The results of the experiment are shown in the following table.

The amount of water was varied from 10 to 20 ml. The plants were grown in a controlled environment. The results of the experiment are shown in the following table.

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The amount of water was varied from 10 to 20 ml. The plants were grown in a controlled environment. The results of the experiment are shown in the following table.

Amount of water (ml)	Height of plant (cm)
10	15.0
15	18.0
20	22.0
10	15.0
15	18.0
20	22.0
10	15.0
15	18.0
20	22.0

The results of the experiment are shown in the following table. The amount of water was varied from 10 to 20 ml. The plants were grown in a controlled environment. The results of the experiment are shown in the following table.

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The amount of water was varied from 10 to 20 ml. The plants were grown in a controlled environment. The results of the experiment are shown in the following table.

For comparison purposes, one stereo model was observed and errors computed in Table XXVII. The curves of these errors are plotted in Figures 30 through 32. The photography was taken by the U. S. Coast and Geodetic Survey with a metrogon lens camera of focal length 152.37 mm at a stated altitude of 13750 feet over the McClure, Ohio, photogrammetric test area. The observations were made in the Wild Autograph A7. Relative orientation was completed in the normal manner using 6 points. Absolute orientation was completed using 3 points as previously discussed to minimize the effect that a warped model, caused by ϕ or ω errors, would have upon the absolute orientation.

Model scale was selected as 1:10,000 in order to provide a desirable position of the model in Z column height. Model scaling was performed using the following set of equations:

$$\Delta S_1^* = S_{o1}^* - S_1^*$$

$$\Delta S_2^* = S_{o2}^* - S_2^*$$

$$\Delta S_3^* = S_{o3}^* - S_3^*$$

S_o^* = observed distance at
model scale

S^* = given distance at
model scale

$$q_1 = \frac{\Delta S_1^*}{S_{o1}^*}$$

$$q_2 = \frac{\Delta S_2^*}{S_{o2}^*}$$

$$q_3 = \frac{\Delta S_3^*}{S_{o3}^*}$$

$$q = 1/3(q_1 + q_2 + q_3)$$

$$bx = bx_o - qbx_o$$

$$by = by_o - qby_o$$

$$bz = bz_o - qbz_o$$



The experiment was carried out in the following manner. The specimen was placed in a container of water and the water level was marked. The specimen was then placed in a container of oil and the oil level was marked. The difference in the two levels was then measured. The specimen was then placed in a container of water and the water level was marked. The specimen was then placed in a container of oil and the oil level was marked. The difference in the two levels was then measured. The specimen was then placed in a container of water and the water level was marked. The specimen was then placed in a container of oil and the oil level was marked. The difference in the two levels was then measured.

The results of the experiment are given in the following table.

The results of the experiment are given in the following table.



$$\begin{aligned} \Delta x &= \frac{1}{2} \Delta t \\ \Delta y &= \frac{1}{2} \Delta t \\ \Delta z &= \frac{1}{2} \Delta t \end{aligned}$$

is a constant value of

the value of

$$\frac{\Delta x}{\Delta t} = \frac{\Delta y}{\Delta t} = \frac{\Delta z}{\Delta t}$$

$$\frac{\Delta x}{\Delta t} = \frac{\Delta y}{\Delta t} = \frac{\Delta z}{\Delta t}$$

$$\frac{\Delta x}{\Delta t} = \frac{\Delta y}{\Delta t} = \frac{\Delta z}{\Delta t}$$

$$\frac{\Delta x}{\Delta t} = \frac{\Delta y}{\Delta t} = \frac{\Delta z}{\Delta t}$$

$$\frac{\Delta x}{\Delta t} = \frac{\Delta y}{\Delta t} = \frac{\Delta z}{\Delta t}$$

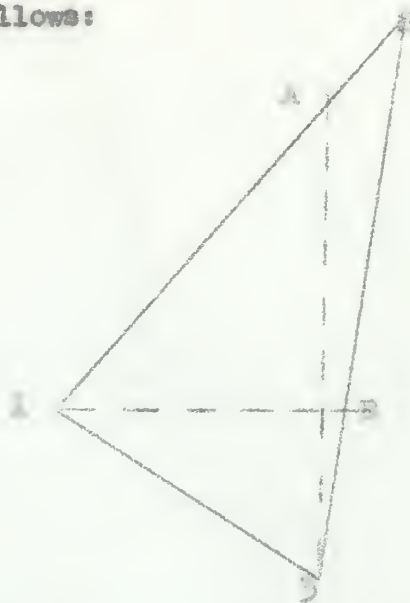
Model levelling was completed as follows:

$$\Delta H_A = \Delta H_1 + \frac{1-A}{1-2}(\Delta H_2 - \Delta H_1)$$

$$\Delta H_B = \Delta H_3 + \frac{3-B}{3-2}(\Delta H_2 - \Delta H_3)$$

$$\omega = \frac{\Delta H_3 - \Delta H_A}{A-3}$$

$$\phi = \frac{\Delta H_B - \Delta H_1}{B-1}$$



Upon completion of orientation, final observations were made on the above 3 points and the following determined:

Actual model scale: 1:9999.12.

Rotation of model necessary to align model with given coordinate system: $\lambda = 1^\circ 42' 52.6$.

Upon completion of observation of all given points in the model, the observed quantities of X and Y were corrected using the following equations, in which m is the scale factor:

$$X' = mX \cos \lambda + mY \sin \lambda$$

$$Y' = mY \cos \lambda - mX \sin \lambda.$$

Consider the following diagram:



$$(x^2 \Delta - y^2 \Delta) \frac{1}{2} \div x^2 \Delta = \frac{1}{2} \Delta$$

$$(x^2 \Delta - y^2 \Delta) \frac{1}{2} \div x^2 \Delta = \frac{1}{2} \Delta$$

$$\frac{x^2 \Delta - y^2 \Delta}{2} = \omega$$

$$\frac{x^2 \Delta - y^2 \Delta}{2} = \omega$$

we also find that the area of the triangle is equal to the area of the rectangle.

the area of the triangle is equal to the area of the rectangle.

the area of the triangle is equal to the area of the rectangle.

the area of the triangle is equal to the area of the rectangle.

the area of the triangle is equal to the area of the rectangle.

the area of the triangle is equal to the area of the rectangle.

the area of the triangle is equal to the area of the rectangle.

the area of the triangle is equal to the area of the rectangle.

$$A \sin \theta = \frac{1}{2} A \sin \theta$$

$$A \sin \theta = \frac{1}{2} A \sin \theta$$

TABLE XXIV

x_{a1} (cm)	x_{a2} (cm)	y_a (cm)
-0.71	- 9.85	1.82
1.26	- 7.88	1.51
-2.46	-11.60	3.12
-0.05	- 9.19	4.00
1.92	- 7.22	3.52
3.49	- 5.65	2.00
-1.37	-10.51	5.83
1.05	- 8.09	5.90
3.00	- 6.14	5.19
-2.53	-11.67	7.58
0.20	- 8.94	8.00
2.59	- 6.55	7.59
-2.18	-11.32	9.77
-0.56	- 9.70	9.99
2.14	- 7.00	9.89
1.78	- 7.36	11.85
7.36	- 1.78	11.85
7.00	- 2.14	9.89
9.70	0.56	9.99
11.32	2.18	9.77
6.55	- 2.59	7.59
8.94	- 0.20	8.00
11.67	2.53	7.58
6.14	- 3.00	5.19
8.09	- 1.05	5.90
10.51	1.37	5.83
5.65	- 3.49	2.00
7.22	- 1.92	3.52
9.19	0.05	4.00
11.60	2.46	3.12
7.88	- 1.26	1.51
9.85	0.71	1.82

x^A (mm)	x^B (mm)	x^C (mm)
10.1	10.1	10.1
10.2	10.2	10.2
10.3	10.3	10.3
10.4	10.4	10.4
10.5	10.5	10.5
10.6	10.6	10.6
10.7	10.7	10.7
10.8	10.8	10.8
10.9	10.9	10.9
11.0	11.0	11.0
11.1	11.1	11.1
11.2	11.2	11.2
11.3	11.3	11.3
11.4	11.4	11.4
11.5	11.5	11.5
11.6	11.6	11.6
11.7	11.7	11.7
11.8	11.8	11.8
11.9	11.9	11.9
12.0	12.0	12.0
12.1	12.1	12.1
12.2	12.2	12.2
12.3	12.3	12.3
12.4	12.4	12.4
12.5	12.5	12.5
12.6	12.6	12.6
12.7	12.7	12.7
12.8	12.8	12.8
12.9	12.9	12.9
13.0	13.0	13.0
13.1	13.1	13.1
13.2	13.2	13.2
13.3	13.3	13.3
13.4	13.4	13.4
13.5	13.5	13.5
13.6	13.6	13.6
13.7	13.7	13.7
13.8	13.8	13.8
13.9	13.9	13.9
14.0	14.0	14.0
14.1	14.1	14.1
14.2	14.2	14.2
14.3	14.3	14.3
14.4	14.4	14.4
14.5	14.5	14.5
14.6	14.6	14.6
14.7	14.7	14.7
14.8	14.8	14.8
14.9	14.9	14.9
15.0	15.0	15.0
15.1	15.1	15.1
15.2	15.2	15.2
15.3	15.3	15.3
15.4	15.4	15.4
15.5	15.5	15.5
15.6	15.6	15.6
15.7	15.7	15.7
15.8	15.8	15.8
15.9	15.9	15.9
16.0	16.0	16.0
16.1	16.1	16.1
16.2	16.2	16.2
16.3	16.3	16.3
16.4	16.4	16.4
16.5	16.5	16.5
16.6	16.6	16.6
16.7	16.7	16.7
16.8	16.8	16.8
16.9	16.9	16.9
17.0	17.0	17.0
17.1	17.1	17.1
17.2	17.2	17.2
17.3	17.3	17.3
17.4	17.4	17.4
17.5	17.5	17.5
17.6	17.6	17.6
17.7	17.7	17.7
17.8	17.8	17.8
17.9	17.9	17.9
18.0	18.0	18.0
18.1	18.1	18.1
18.2	18.2	18.2
18.3	18.3	18.3
18.4	18.4	18.4
18.5	18.5	18.5
18.6	18.6	18.6
18.7	18.7	18.7
18.8	18.8	18.8
18.9	18.9	18.9
19.0	19.0	19.0
19.1	19.1	19.1
19.2	19.2	19.2
19.3	19.3	19.3
19.4	19.4	19.4
19.5	19.5	19.5
19.6	19.6	19.6
19.7	19.7	19.7
19.8	19.8	19.8
19.9	19.9	19.9
20.0	20.0	20.0
20.1	20.1	20.1
20.2	20.2	20.2
20.3	20.3	20.3
20.4	20.4	20.4
20.5	20.5	20.5
20.6	20.6	20.6
20.7	20.7	20.7
20.8	20.8	20.8
20.9	20.9	20.9
21.0	21.0	21.0
21.1	21.1	21.1
21.2	21.2	21.2
21.3	21.3	21.3
21.4	21.4	21.4
21.5	21.5	21.5
21.6	21.6	21.6
21.7	21.7	21.7
21.8	21.8	21.8
21.9	21.9	21.9
22.0	22.0	22.0
22.1	22.1	22.1
22.2	22.2	22.2
22.3	22.3	22.3
22.4	22.4	22.4
22.5	22.5	22.5
22.6	22.6	

TABLE XXIV--Continued

Lens 13

e_1 (m)	e_2 (m)	$e_1 - e_2$ (m)	py (microns)	$\Delta X''$ (m)	$f\Delta X''/x_{a2}$ (m)	e_o (m)
-2.84	-1.54	-1.30	- 5.9	0.065	-0.10	-1.44
-2.84	-2.68	-0.16	- 6.0	-0.011	0.02	-2.70
-3.13	0.55	-3.68	-28.7	0.747	-0.99	1.54
-3.13	-1.54	-1.59	-15.9	0.005	-0.01	-1.53
-3.13	-2.68	-0.45	-4.0	-0.044	0.09	-2.77
-3.13	-3.28	0.15	+ 0.8	0.021	-0.06	-3.22
-3.28	0.55	-3.83	-55.8	0.392	-0.57	1.12
-3.28	-1.54	-1.74	-25.7	-0.105	0.20	-1.74
-3.28	-2.68	-0.60	- 7.8	-0.079	0.20	-2.88
-2.68	-0.09	-2.59	-49.1	0.544	-0.72	0.63
-2.68	0.55	-3.23	-64.6	-0.041	0.07	0.48
-2.68	-1.54	-1.14	-21.6	-0.138	0.32	-1.86
-1.54	0.19	-1.73	-42.3	0.304	-0.41	0.60
-1.54	-0.09	-1.45	-36.2	0.056	-0.09	0
-1.54	0.55	-2.09	-51.7	-0.223	0.49	0.06
0.55	-0.09	0.64	+19.0	0.060	-0.13	0.04
-0.09	0.55	-0.64	-19.0	-0.060	0.52	0.03
0.55	-1.54	2.09	51.7	0.223	-1.60	0.06
-0.09	-1.54	1.45	36.2	-0.056	-1.54	0
0.19	-1.54	1.73	42.3	-0.304	-2.14	0.60
-1.54	-2.68	1.14	21.6	0.138	-0.82	-1.86
0.55	-2.68	3.23	64.6	0.041	-3.15	0.47
-0.09	-2.68	2.59	49.1	-0.544	-3.31	0.63
-2.68	-3.28	0.60	7.8	0.079	-0.40	-2.88
-1.54	-3.28	1.74	25.7	0.105	-1.54	-1.74
0.55	-3.28	3.83	55.8	-0.392	-4.40	1.12
-3.28	-3.13	-0.15	- 0.8	-0.021	+0.09	-3.22
-2.68	-3.13	0.45	4.0	0.044	-0.35	-2.78
-1.54	-3.13	1.59	15.9	-0.005	-1.60	-1.53
0.55	-3.13	3.68	28.7	-0.747	-4.67	1.54
-2.68	-2.84	0.16	6.0	0.011	-0.13	-2.71
-1.54	-2.84	1.30	5.9	-0.065	-1.41	-1.43

[illegible]

TABLE XXIV—Continued

Lens 18

σ_1 (m)	σ_2 (m)	$\sigma_1 - \sigma_2$ (m)	DV (microns)	$\Delta X''$ (m)	$f\Delta X''/x_{s_2}$ (m)	σ_0 (m)
0.56	0	0.56	2.5	-0.028	0.04	-0.04
0.56	-0.20	0.76	2.9	0.054	-0.10	-0.10
0.33	0	0.33	2.6	-0.067	0.09	-0.09
0.33	0	0.33	3.3	-0.001	0	0
0.33	-0.20	0.53	4.7	0.052	-0.11	-0.09
0.33	-0.20	0.53	2.7	0.074	-0.21	0.01
-0.20	0	-0.20	- 2.9	0.020	-0.03	0.03
-0.20	0	-0.20	- 3.0	-0.012	0.02	-0.02
-0.20	-0.20	0	0	0	0	-0.20
-0.20	-0.15	-0.05	- 0.9	0.011	-0.01	-0.14
-0.20	0	-0.20	- 2.0	-0.003	0	0
-0.20	0	-0.20	- 3.6	-0.024	0.06	-0.06
0	-0.24	0.24	5.9	-0.042	0.06	-0.30
0	-0.15	0.15	3.7	-0.006	0.01	-0.16
0	0	0	0	0	0	0
0	-0.15	0.15	4.4	0.014	-0.03	-0.12
-0.15	0	-0.15	- 4.4	-0.014	0.12	-0.12
0	0	0	0	0	0	0
-0.15	0	-0.15	- 3.7	0.006	0.16	-0.16
-0.24	0	-0.24	- 5.9	0.042	0.30	-0.30
0	-0.20	0.20	3.6	0.024	-0.14	-0.06
0	-0.20	0.20	2.0	0.003	-0.21	0.01
-0.15	-0.20	0.05	0.9	-0.011	-0.01	-0.13
-0.20	-0.20	0	0	0	0	-0.20
0	-0.20	0.20	3.0	0.012	-0.18	-0.02
0	-0.20	0.20	2.9	-0.020	-0.22	0.02
-0.20	0.33	-0.53	- 2.7	-0.074	0.33	0
-0.20	0.33	-0.53	- 4.7	-0.052	0.42	-0.09
0	0.33	-0.33	- 3.3	0.001	0.32	0.01
0	0.33	-0.33	- 2.6	0.067	0.42	-0.09
-0.20	0.56	-0.76	- 2.9	-0.054	0.66	-0.10
0	0.56	-0.56	- 2.5	0.028	0.61	-0.05

TABLE XXIV--Continued

Average						
θ_1 (m)	θ_2 (m)	$\theta_1 - \theta_2$ (m)	ρ_V (microns)	$\Delta X''$ (m)	$f\Delta X''/\pi_{a_2}$ (m)	θ_0 (m)
-0.54	-0.02	-0.52	- 2.4	0.026	-0.04	0.02
-0.54	-0.55	0.01	0	0.001	0	-0.55
-0.58	+0.27	-0.85	- 6.6	0.173	-0.23	0.50
-0.58	-0.02	-0.56	- 5.6	0.002	0	-0.02
-0.58	-0.55	-0.03	- 0.3	-0.003	+0.01	-0.56
-0.58	-0.80	0.22	1.1	0.031	-0.08	-0.72
-0.80	0.27	-1.07	-15.6	0.110	-0.16	0.43
-0.80	-0.02	-0.78	-11.5	-0.047	+0.09	-0.11
-0.80	-0.55	-0.25	- 3.2	-0.033	+0.08	-0.63
-0.55	-0.12	-0.43	- 8.1	0.091	-0.12	0
-0.55	0.27	-0.82	-16.4	-0.010	+0.02	0.24
-0.55	-0.02	-0.53	-10.1	-0.064	+0.15	-0.17
-0.02	-0.32	0.30	7.3	-0.053	+0.07	-0.39
-0.02	-0.12	0.10	2.5	-0.004	+0.01	-0.13
-0.02	0.27	-0.29	- 4.7	-0.031	+0.07	0.20
0.27	-0.12	0.39	11.6	0.036	-0.08	-0.04
-0.12	0.27	-0.39	-11.6	-0.036	+0.31	-0.04
0.27	-0.02	0.29	4.7	0.031	-0.22	0.20
-0.12	-0.02	-0.10	- 2.5	0.004	+0.11	-0.13
-0.32	-0.02	-0.30	- 7.3	0.053	+0.37	-0.39
-0.02	-0.55	0.53	10.1	0.064	-0.38	-0.17
0.27	-0.55	0.82	16.4	0.010	-0.77	0.22
-0.12	-0.55	0.43	8.1	-0.091	-0.55	0
-0.55	-0.80	0.25	3.2	0.033	-0.17	-0.63
-0.02	-0.80	0.78	11.5	0.047	-0.69	-0.11
0.27	-0.80	1.07	15.6	-0.110	-1.23	0.43
-0.80	-0.58	-0.22	- 1.1	-0.031	+0.14	-0.72
-0.55	-0.58	0.03	0.3	0.003	-0.02	-0.56
-0.02	-0.58	0.56	5.6	-0.002	-0.61	0.03
0.27	-0.58	0.85	6.6	-0.173	-1.08	0.50
-0.55	-0.54	-0.01	0	-0.001	+0.01	-0.55
-0.02	-0.54	0.52	2.4	-0.026	-0.56	0.02

[illegible]

E1

Figure 12

Y-Parallax in microns

Stereo model formed with Lens #13

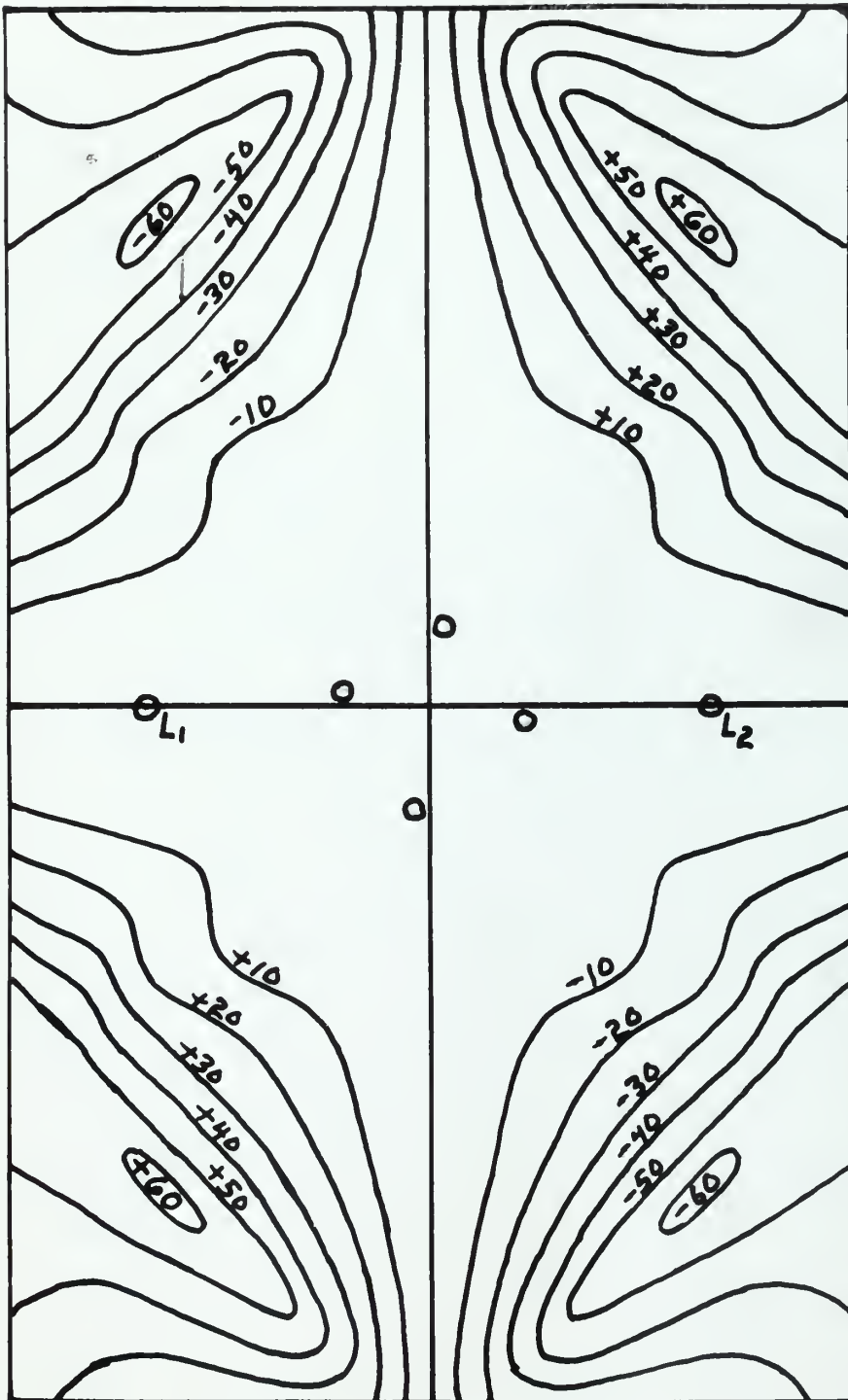


Figure 1

Y-Parallax in microns

Stereo model formed with Average Lens

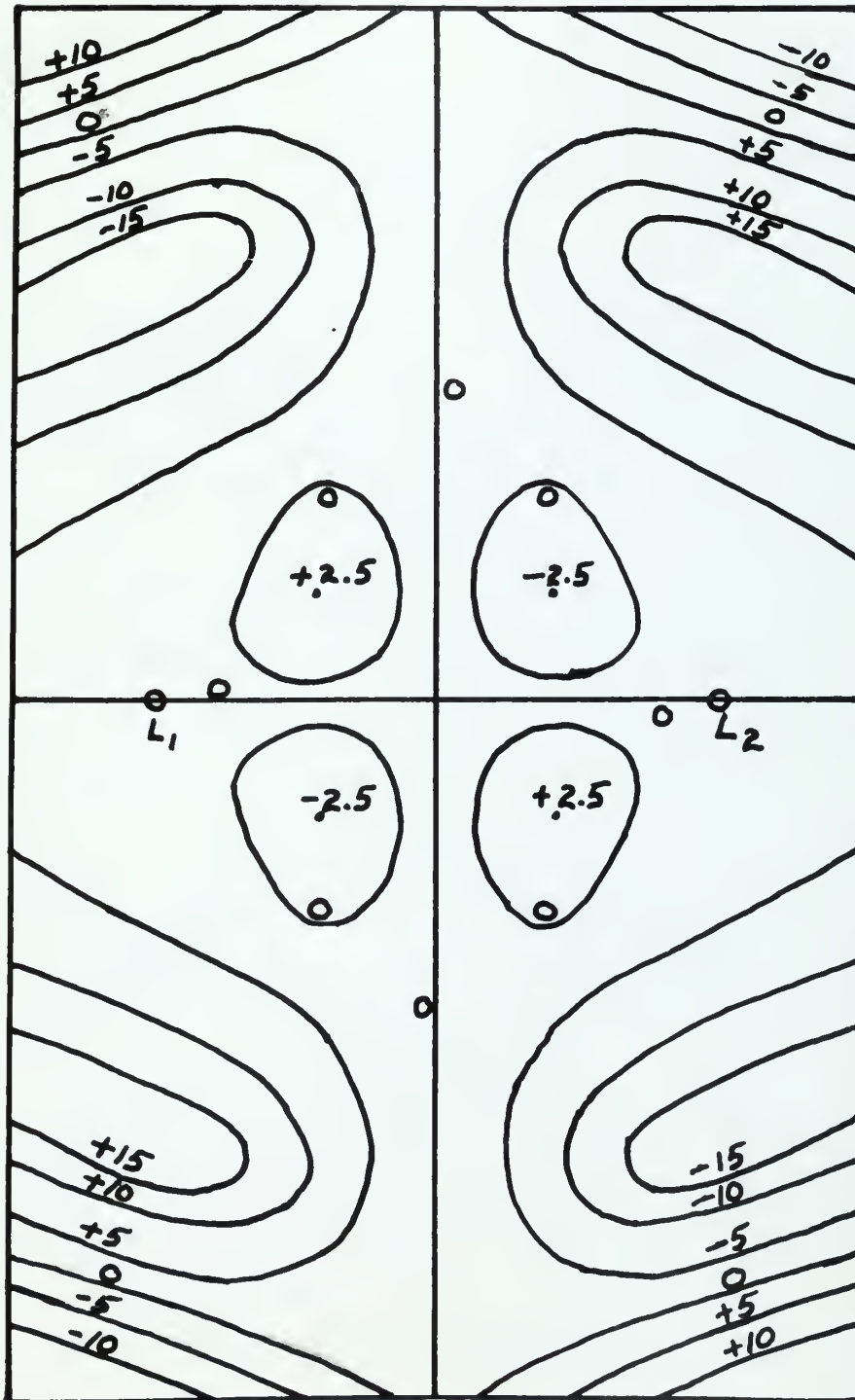
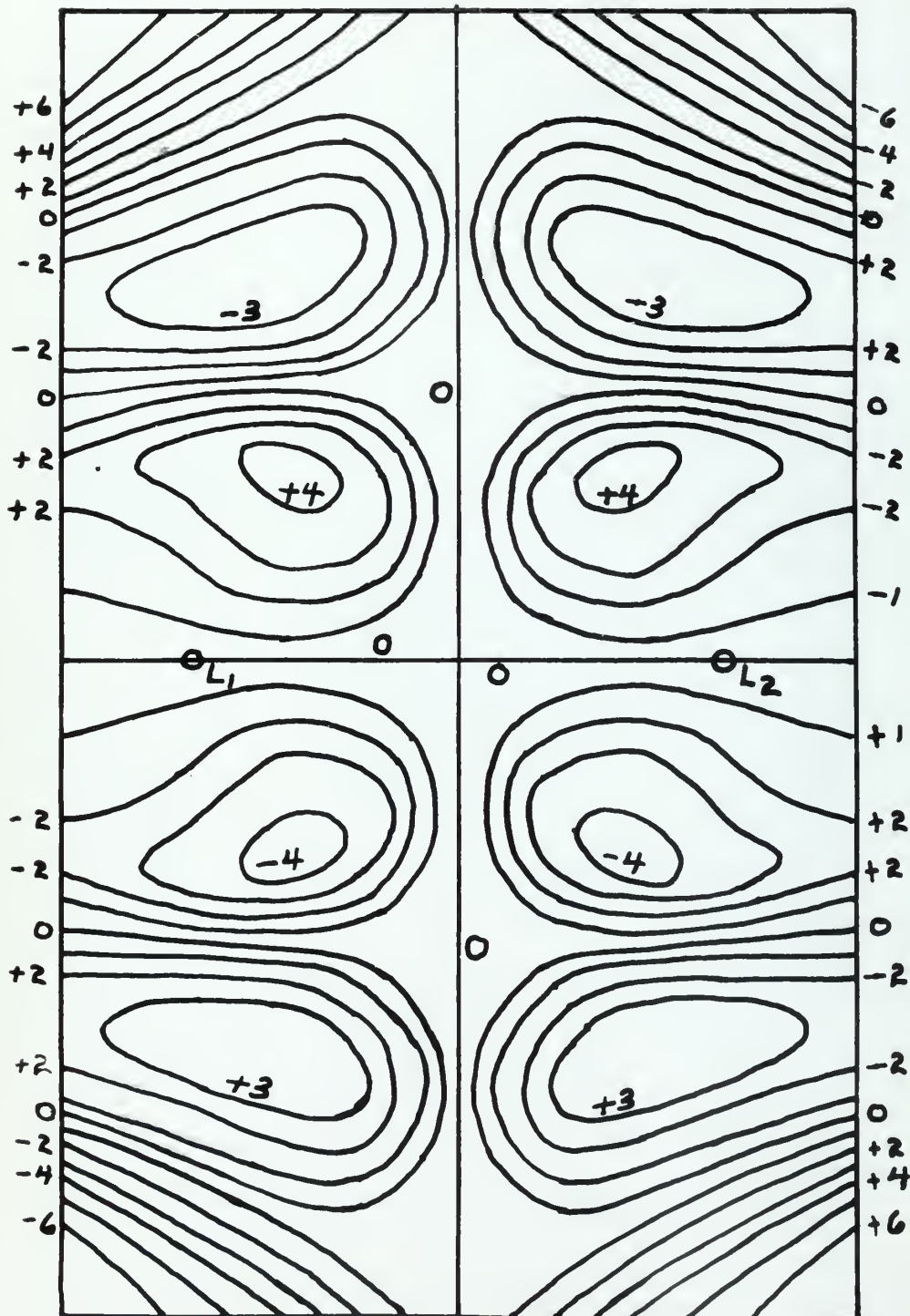


Figure 14

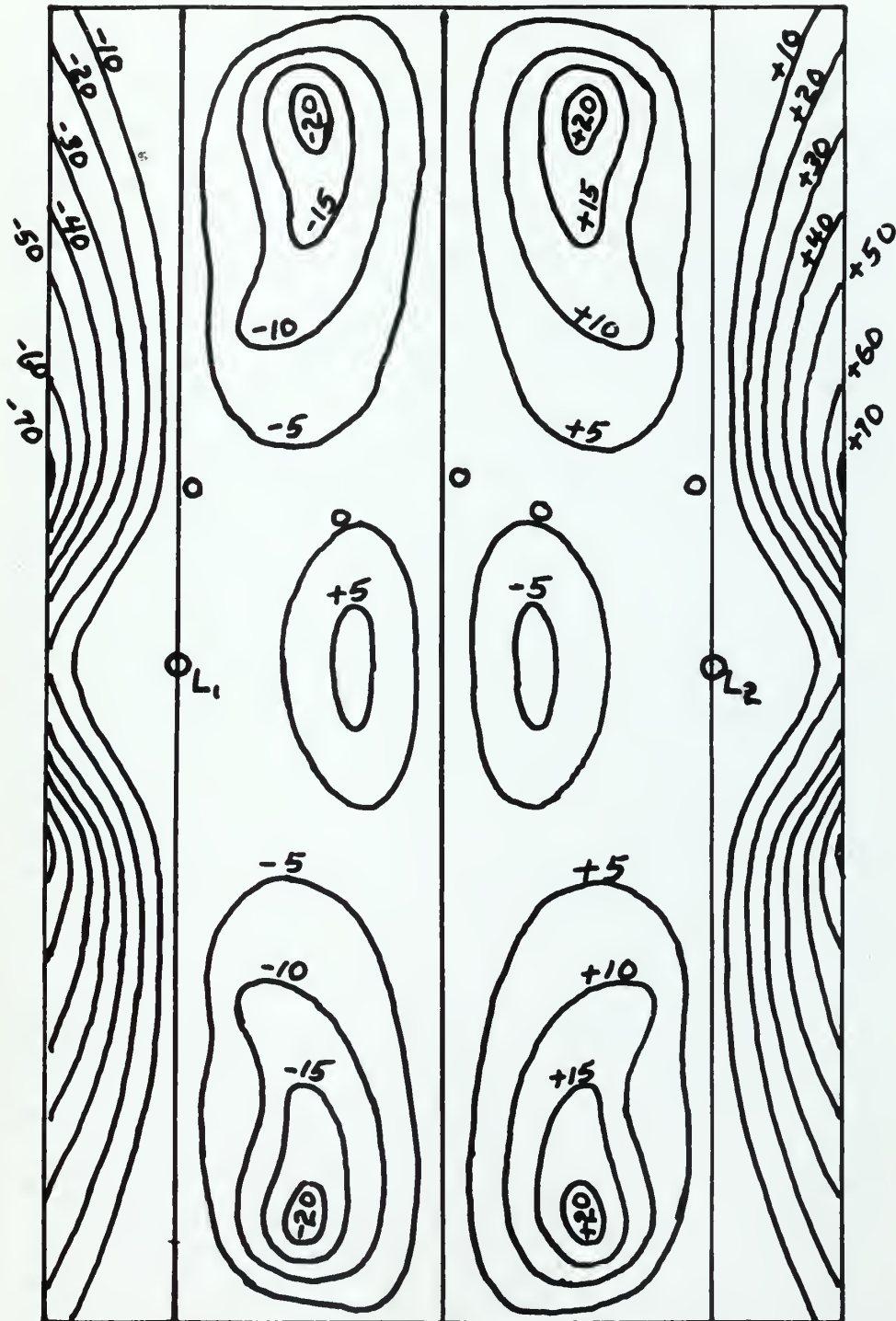
Y-Parallax in microns

Stereo model formed with Lens #18



X-direction errors in centimeters
Stereo model formed with Lens #13

Figure 15



X-direction errors in centimeters
Stereo model formed with Average Lens

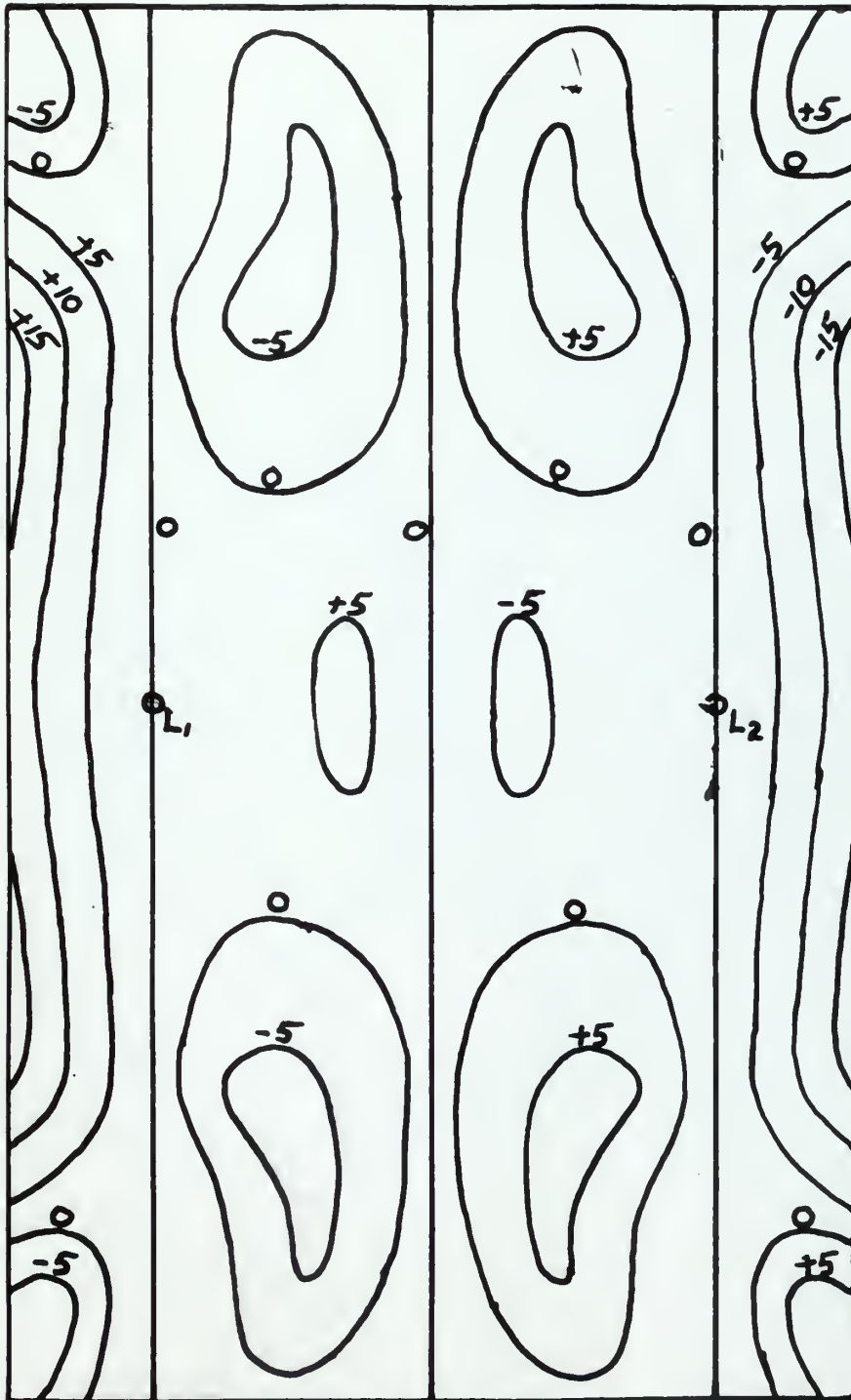
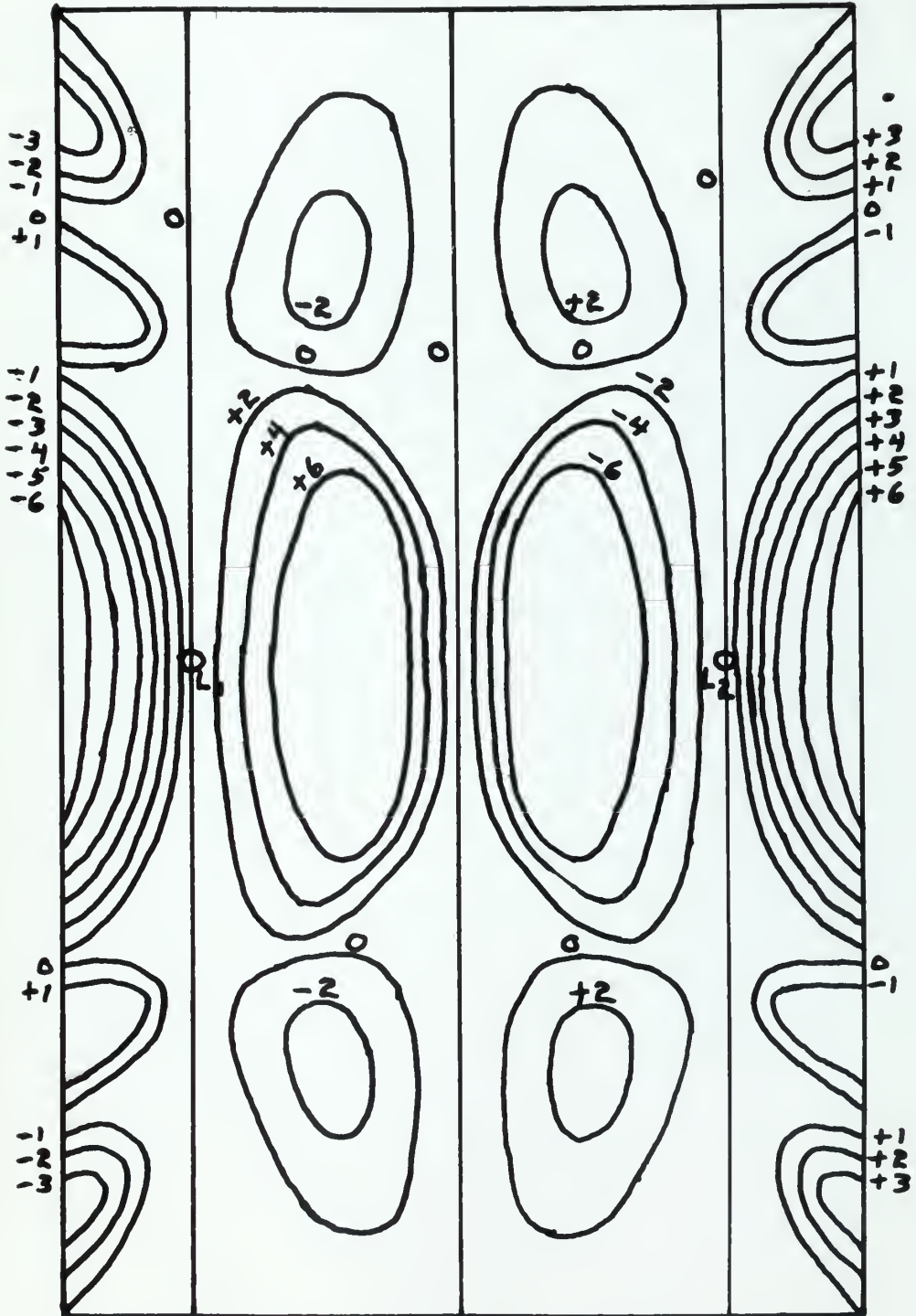
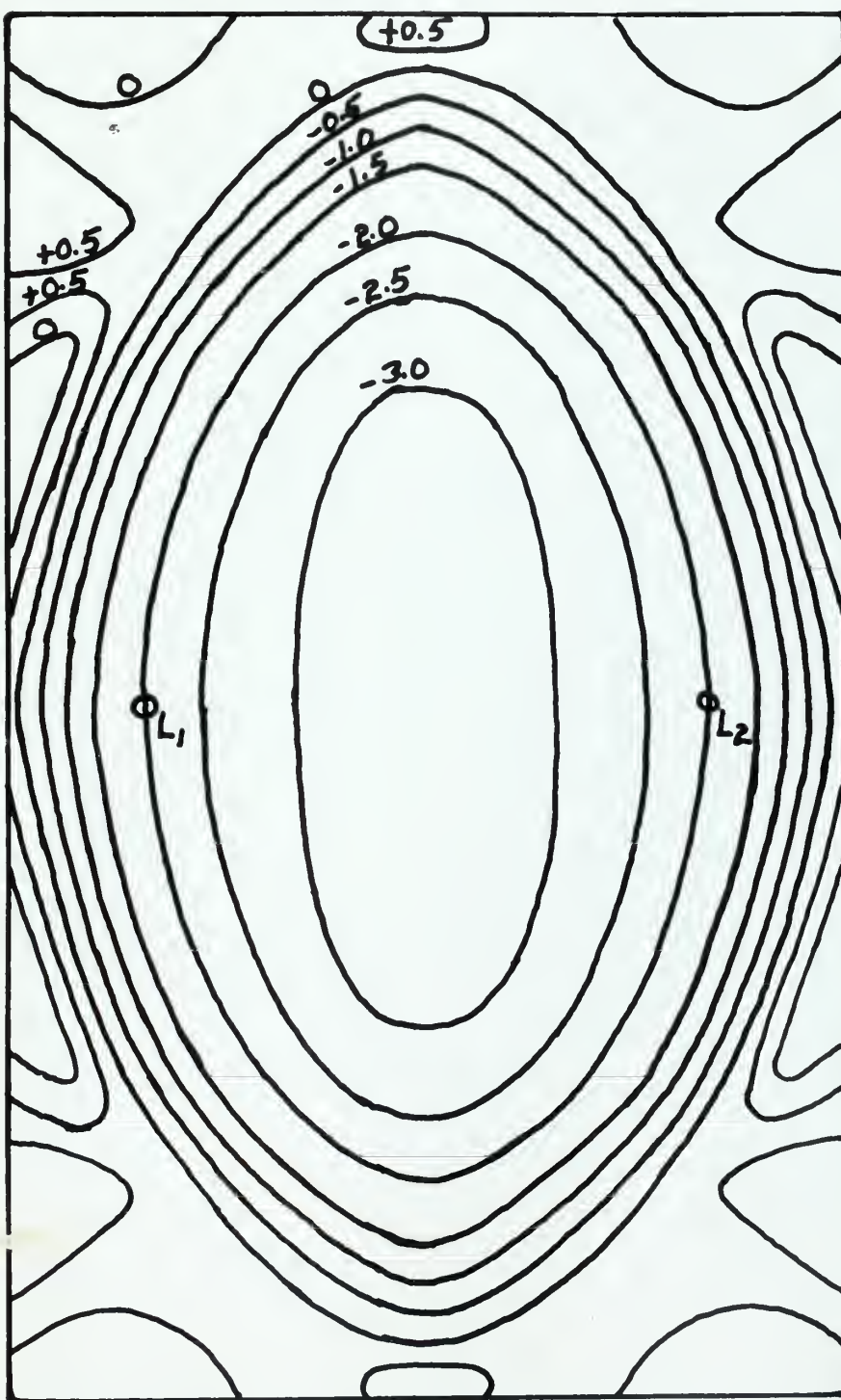


Figure 17

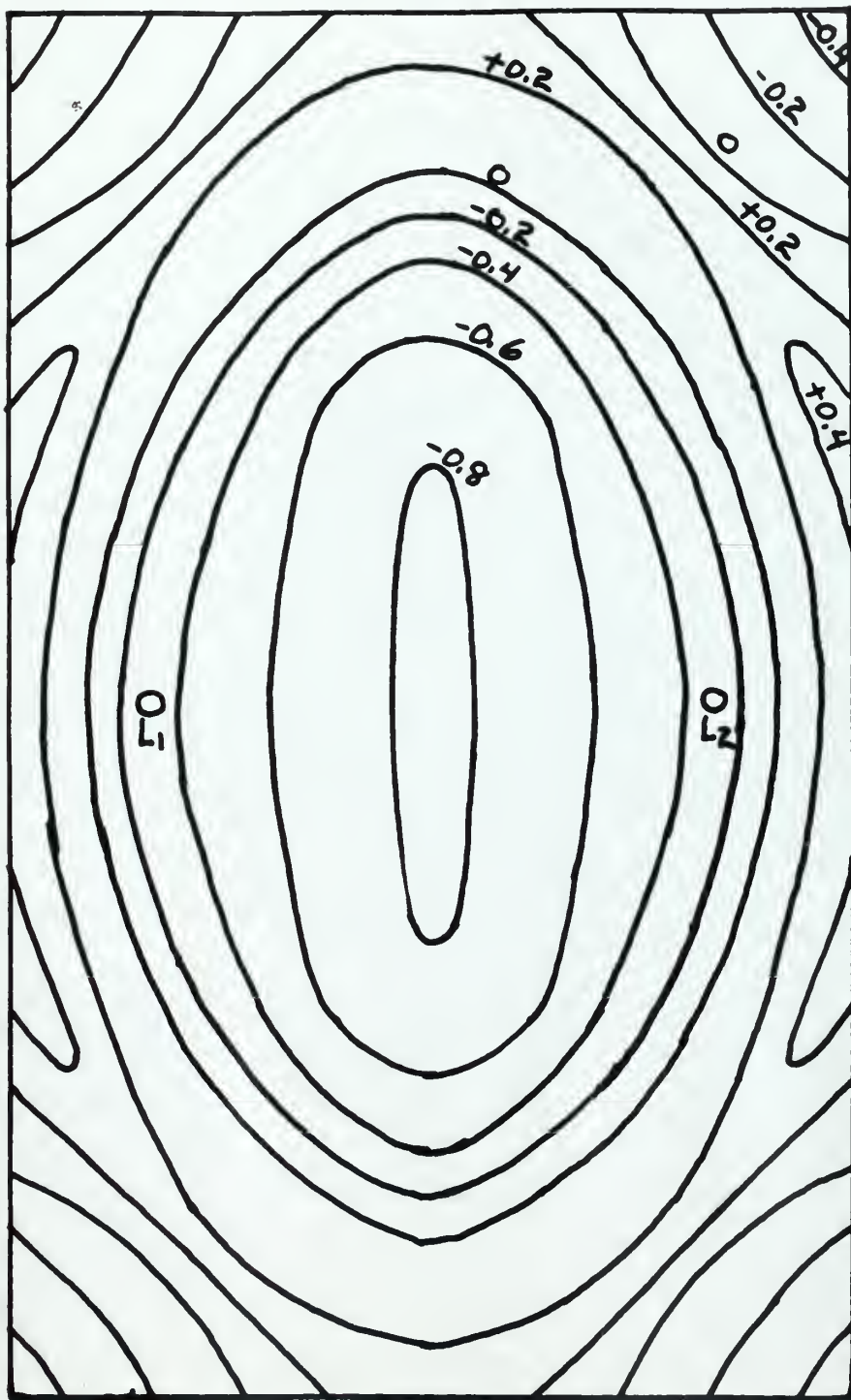
λ -direction errors in centimeters
Stereo model formed with Lens #18



Elevation errors in meters
Stereo model formed with Lens #13



Elevation errors in meters
Stereo model formed with Average Lens



Elevation errors in meters
Stereo model formed with Lens #18

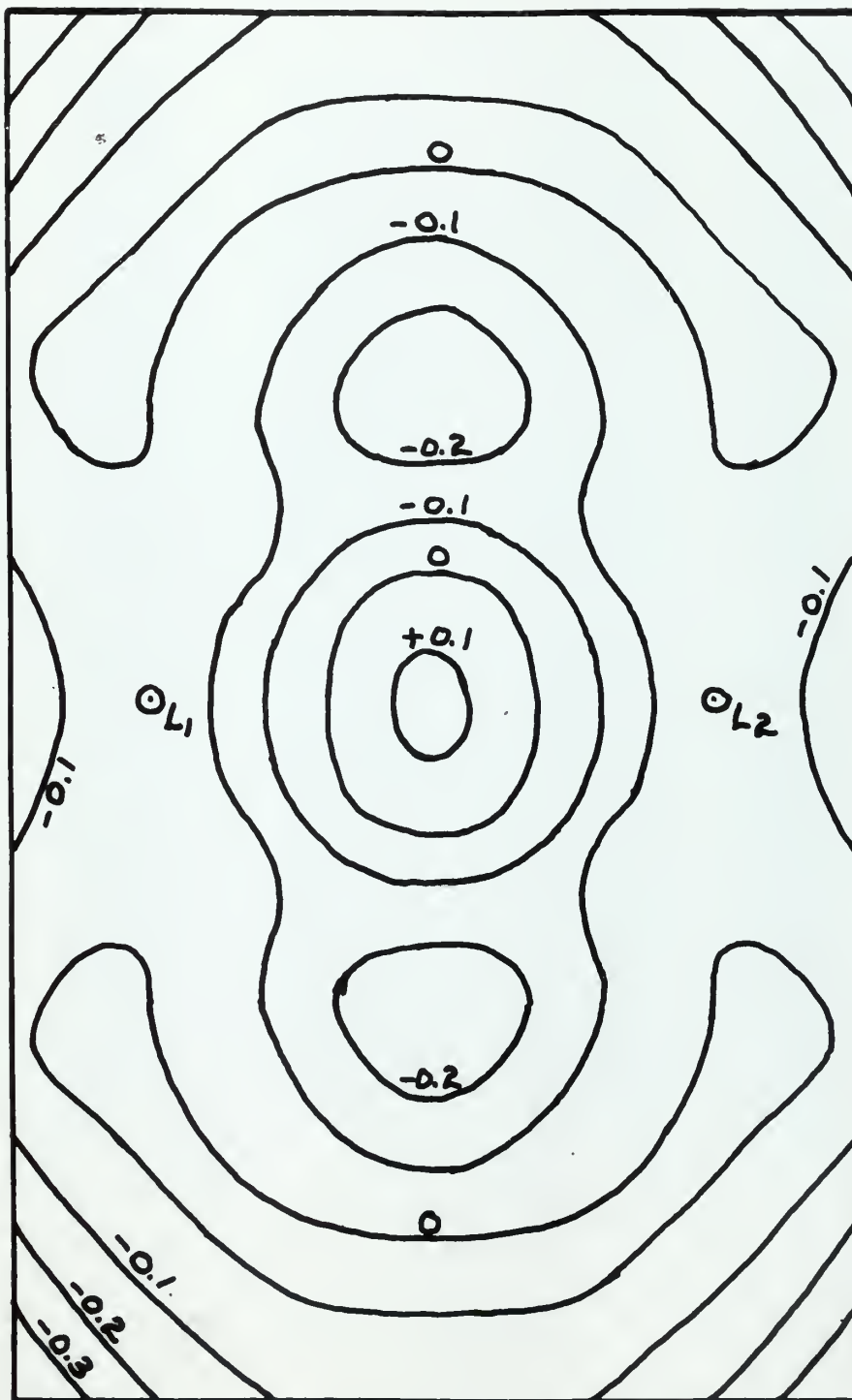


TABLE XXV

x	$(x - b)$	$\frac{(x - b)^2}{b}$	$2 + 4$	$\frac{x - b}{b}$
(cm)	(mm)	(mm)	(mm)	(mm)
- 9.85	-189.9	394.555	648.566	-2.0777
- 7.88	-170.2	316.929	570.940	-1.8621
-11.60	-207.4	470.611	724.622	-2.2691
- 9.19	-183.3	367.608	621.619	-2.0055
- 7.22	-163.6	292.828	546.839	-1.7899
- 5.65	-147.9	239.332	493.343	-1.6182
-10.51	-196.5	422.455	676.466	-2.1499
- 8.09	-172.3	324.803	578.814	-1.8851
- 6.34	-152.8	255.451	509.462	-1.6718
-11.67	-208.1	473.802	727.813	-2.2768
- 8.94	-180.8	357.640	611.651	-1.9781
- 6.55	-156.9	269.335	523.346	-1.7166
-11.32	-204.6	457.997	712.008	-2.2385
- 9.70	-188.4	388.349	642.360	-2.0613
- 7.00	-161.4	285.016	539.027	-1.7659
- 7.36	-165.0	297.875	551.886	-1.8053
-1.78	-109.2	139.461	384.472	-1.1947
-2.14	-112.8	139.206	393.217	-1.2341
0.56	- 85.8	80.540	334.551	-0.9387
2.18	- 69.6	53.000	307.011	-0.7615
-2.59	-117.3	150.543	404.554	-1.2834
-0.20	- 93.4	95.445	349.456	-1.0219
2.53	- 66.1	46.429	300.440	-0.7024
-3.00	-121.4	162.243	425.254	-1.3282
-1.05	-101.9	113.608	367.619	-1.1149
1.37	- 77.7	66.053	320.064	-0.8501
-3.49	-126.3	174.521	428.532	-1.3818
-1.92	-110.6	133.837	367.848	-1.2161
0.05	- 90.9	90.400	344.411	-0.9945
2.46	- 66.8	48.824	302.835	-0.7309
-1.26	-104.0	118.342	372.353	-1.1379
0.71	- 84.3	77.750	331.761	-0.9223

TABLE 1

$\lambda - \mu$ (mm)	$\lambda + \mu$ (mm)	$\frac{\lambda - \mu}{\lambda + \mu}$ (mm)	$\lambda - \mu$ (mm)	μ (mm)
1170.0	332.550	232.400	2.000	1170.0
1180.0	332.550	232.400	2.000	1180.0
1190.0	332.550	232.400	2.000	1190.0
1200.0	332.550	232.400	2.000	1200.0
1210.0	332.550	232.400	2.000	1210.0
1220.0	332.550	232.400	2.000	1220.0
1230.0	332.550	232.400	2.000	1230.0
1240.0	332.550	232.400	2.000	1240.0
1250.0	332.550	232.400	2.000	1250.0
1260.0	332.550	232.400	2.000	1260.0
1270.0	332.550	232.400	2.000	1270.0
1280.0	332.550	232.400	2.000	1280.0
1290.0	332.550	232.400	2.000	1290.0
1300.0	332.550	232.400	2.000	1300.0
1310.0	332.550	232.400	2.000	1310.0
1320.0	332.550	232.400	2.000	1320.0
1330.0	332.550	232.400	2.000	1330.0
1340.0	332.550	232.400	2.000	1340.0
1350.0	332.550	232.400	2.000	1350.0
1360.0	332.550	232.400	2.000	1360.0
1370.0	332.550	232.400	2.000	1370.0
1380.0	332.550	232.400	2.000	1380.0
1390.0	332.550	232.400	2.000	1390.0
1400.0	332.550	232.400	2.000	1400.0
1410.0	332.550	232.400	2.000	1410.0
1420.0	332.550	232.400	2.000	1420.0
1430.0	332.550	232.400	2.000	1430.0
1440.0	332.550	232.400	2.000	1440.0
1450.0	332.550	232.400	2.000	1450.0
1460.0	332.550	232.400	2.000	1460.0
1470.0	332.550	232.400	2.000	1470.0
1480.0	332.550	232.400	2.000	1480.0
1490.0	332.550	232.400	2.000	1490.0
1500.0	332.550	232.400	2.000	1500.0
1510.0	332.550	232.400	2.000	1510.0
1520.0	332.550	232.400	2.000	1520.0
1530.0	332.550	232.400	2.000	1530.0
1540.0	332.550	232.400	2.000	1540.0
1550.0	332.550	232.400	2.000	1550.0
1560.0	332.550	232.400	2.000	1560.0
1570.0	332.550	232.400	2.000	1570.0
1580.0	332.550	232.400	2.000	1580.0
1590.0	332.550	232.400	2.000	1590.0
1600.0	332.550	232.400	2.000	1600.0
1610.0	332.550	232.400	2.000	1610.0
1620.0	332.550	232.400	2.000	1620.0
1630.0	332.550	232.400	2.000	1630.0
1640.0	332.550	232.400	2.000	1640.0
1650.0	332.550	232.400	2.000	1650.0
1660.0	332.550	232.400	2.000	1660.0
1670.0	332.550	232.400	2.000	1670.0
1680.0	332.550	232.400	2.000	1680.0
1690.0	332.550	232.400	2.000	1690.0
1700.0	332.550	232.400	2.000	1700.0
1710.0	332.550	232.400	2.000	1710.0
1720.0	332.550	232.400	2.000	1720.0
1730.0	332.550	232.400	2.000	1730.0
1740.0	332.550	232.400	2.000	1740.0
1750.0	332.550	232.400	2.000	1750.0
1760.0	332.550	232.400	2.000	1760.0
1770.0	332.550	232.400	2.000	1770.0
1780.0	332.550	232.400	2.000	1780.0
1790.0	332.550	232.400	2.000	1790.0
1800.0	332.550	232.400	2.000	1800.0
1810.0	332.550	232.400	2.000	1810.0
1820.0	332.550	232.400	2.000	1820.0
1830.0	332.550	232.400	2.000	1830.0
1840.0	332.550	232.400	2.000	1840.0
1850.0	332.550	232.400	2.000	1850.0
1860.0	332.550	232.400	2.000	1860.0
1870.0	332.550	232.400	2.000	1870.0
1880.0	332.550	232.400	2.000	1880.0
1890.0	332.550	232.400	2.000	1890.0
1900.0	332.550	232.400	2.000	1900.0
1910.0	332.550	232.400	2.000	1910.0
1920.0	332.550	232.400	2.000	1920.0
1930.0	332.550	232.400	2.000	1930.0
1940.0	332.550	232.400	2.000	1940.0
1950.0	332.550	232.400	2.000	1950.0
1960.0	332.550	232.400	2.000	1960.0
1970.0	332.550	232.400	2.000	1970.0
1980.0	332.550	232.400	2.000	1980.0
1990.0	332.550	232.400	2.000	1990.0
2000.0	332.550	232.400	2.000	2000.0

TABLE XIV--Continued

Lens 13 dh (m)	Ave. Lens dh (m)	Lens 18 dh (m)	Lens 13 σ^2 (m)	Ave. Lens σ^2 (m)	Lens 18 σ^2 (m)
-18.00	1.22	2.05	16.46	-1.24	-2.05
-15.80	1.07	1.80	13.12	-1.62	-2.00
-20.19	1.37	2.30	19.64	-1.10	-2.30
-17.23	1.17	1.96	15.69	-1.19	-1.96
-15.12	1.02	1.72	12.44	-1.57	-1.92
-13.64	0.92	1.55	10.36	-1.72	-1.75
-18.80	1.27	2.14	18.25	-1.00	-2.14
-16.02	1.08	1.82	14.48	-1.10	-1.82
-14.08	0.95	1.60	11.40	-1.50	-1.80
-20.22	1.37	2.31	20.19	-1.49	-2.46
-16.94	1.15	1.93	16.39	-0.88	-1.93
-14.46	0.98	1.65	12.92	-1.00	-1.65
-19.82	1.34	2.26	19.63	-1.66	-2.50
-17.82	1.21	2.03	17.73	-1.33	-2.18
-14.90	1.01	1.70	14.35	-0.74	-1.70
-15.26	1.03	1.74	15.17	-1.15	-1.89
-10.72	0.73	1.22	10.17	-0.46	-1.22
-10.95	0.74	1.25	9.41	-0.76	-1.25
- 9.48	0.64	1.08	7.94	-0.66	-1.08
- 8.85	0.60	1.01	7.31	-0.62	-1.01
-11.25	0.76	1.28	8.57	-1.15	-1.48
- 9.84	0.67	1.12	7.16	-1.22	-1.32
- 8.72	0.59	0.99	6.04	-1.14	-1.19
-11.53	0.78	1.31	8.25	-1.58	-0.98
-10.30	0.70	1.17	7.02	-1.50	-1.37
- 9.14	0.62	1.04	5.86	-1.42	-1.24
-11.88	0.80	1.35	8.75	-1.38	-1.02
-10.81	0.73	1.23	7.68	-1.31	-0.90
- 9.72	0.67	1.11	6.59	-1.25	-0.78
- 8.76	0.59	1.00	5.63	-1.17	-0.67
-10.41	0.71	1.19	7.57	-1.25	-0.63
- 9.42	0.73	1.07	6.58	-1.27	-0.51

[illegible]

TABLE XXVI

x_{a1} (cm)	x_{a2} (cm)	y_a (cm)
-0.71	- 9.85	1.82
1.26	- 7.88	1.51
-2.46	-11.60	3.12
-0.05	- 9.19	4.00
1.92	- 7.22	3.52
3.49	- 5.65	2.00
-1.37	-10.51	5.83
1.05	- 8.09	5.90
3.00	- 6.14	5.19
-2.53	-11.67	7.58
0.20	- 8.94	8.00
2.59	- 6.55	7.59
-2.18	-11.32	9.77
-0.56	- 9.70	9.99
2.14	- 7.00	9.89
1.78	- 7.36	11.85
7.36	- 1.78	11.85
7.00	-2.14	9.89
9.70	0.56	9.99
11.32	2.18	9.77
6.55	- 2.59	7.59
8.94	- 0.20	8.00
11.67	2.53	7.58
6.14	- 3.00	5.19
8.09	- 1.05	5.90
10.51	1.37	5.83
5.65	- 3.49	2.00
7.22	-1.92	3.52
9.19	0.05	4.00
11.60	2.46	3.12
7.88	- 1.26	1.51
9.85	0.71	1.82

No.	Time (min)			No.
	t_1	t_2	t_3	
1	21.1	21.0	21.0	1
2	22.1	21.7	21.5	2
3	23.1	21.4	21.4	3
4	24.1	21.2	21.4	4
5	25.1	21.0	21.4	5
6	26.1	20.8	21.4	6
7	27.1	20.6	21.4	7
8	28.1	20.4	21.4	8
9	29.1	20.2	21.4	9
10	30.1	20.0	21.4	10
11	31.1	19.8	21.4	11
12	32.1	19.6	21.4	12
13	33.1	19.4	21.4	13
14	34.1	19.2	21.4	14
15	35.1	19.0	21.4	15
16	36.1	18.8	21.4	16
17	37.1	18.6	21.4	17
18	38.1	18.4	21.4	18
19	39.1	18.2	21.4	19
20	40.1	18.0	21.4	20
21	41.1	17.8	21.4	21
22	42.1	17.6	21.4	22
23	43.1	17.4	21.4	23
24	44.1	17.2	21.4	24
25	45.1	17.0	21.4	25
26	46.1	16.8	21.4	26
27	47.1	16.6	21.4	27
28	48.1	16.4	21.4	28
29	49.1	16.2	21.4	29
30	50.1	16.0	21.4	30
31	51.1	15.8	21.4	31
32	52.1	15.6	21.4	32
33	53.1	15.4	21.4	33
34	54.1	15.2	21.4	34
35	55.1	15.0	21.4	35
36	56.1	14.8	21.4	36
37	57.1	14.6	21.4	37
38	58.1	14.4	21.4	38
39	59.1	14.2	21.4	39
40	60.1	14.0	21.4	40
41	61.1	13.8	21.4	41
42	62.1	13.6	21.4	42
43	63.1	13.4	21.4	43
44	64.1	13.2	21.4	44
45	65.1	13.0	21.4	45
46	66.1	12.8	21.4	46
47	67.1	12.6	21.4	47
48	68.1	12.4	21.4	48
49	69.1	12.2	21.4	49
50	70.1	12.0	21.4	50
51	71.1	11.8	21.4	51
52	72.1	11.6	21.4	52
53	73.1	11.4	21.4	53
54	74.1	11.2	21.4	54
55	75.1	11.0	21.4	55
56	76.1	10.8	21.4	56
57	77.1	10.6	21.4	57
58	78.1	10.4	21.4	58
59	79.1	10.2	21.4	59
60	80.1	10.0	21.4	60
61	81.1	9.8	21.4	61
62	82.1	9.6	21.4	62
63	83.1	9.4	21.4	63
64	84.1	9.2	21.4	64
65	85.1	9.0	21.4	65
66	86.1	8.8	21.4	66
67	87.1	8.6	21.4	67
68	88.1	8.4	21.4	68
69	89.1	8.2	21.4	69
70	90.1	8.0	21.4	70
71	91.1	7.8	21.4	71
72	92.1	7.6	21.4	72
73	93.1	7.4	21.4	73
74	94.1	7.2	21.4	74
75	95.1	7.0	21.4	75
76	96.1	6.8	21.4	76
77	97.1	6.6	21.4	77
78	98.1	6.4	21.4	78
79	99.1	6.2	21.4	79
80	100.1	6.0	21.4	80
81	101.1	5.8	21.4	81
82	102.1	5.6	21.4	82
83	103.1	5.4	21.4	83
84	104.1	5.2	21.4	84
85	105.1	5.0	21.4	85
86	106.1	4.8	21.4	86
87	107.1	4.6	21.4	87
88	108.1	4.4	21.4	88
89	109.1	4.2	21.4	89
90	110.1	4.0	21.4	90
91	111.1	3.8	21.4	91
92	112.1	3.6	21.4	92
93	113.1	3.4	21.4	93
94	114.1	3.2	21.4	94
95	115.1	3.0	21.4	95
96	116.1	2.8	21.4	96
97	117.1	2.6	21.4	97
98	118.1	2.4	21.4	98
99	119.1	2.2	21.4	99
100	120.1	2.0	21.4	100

TABLE XXVI—Continued

Lens 13						
θ_1	θ_2	$\theta_1 - \theta_2$	ν	$\Delta X''$	$f \Delta X'' / x_{a2}$	θ_0
(m)	(m)	(m)	(microns)	(m)	(m)	(m)
-2.84	16.46	-19.30	- 87.8	0.961	-1.50	17.96
-2.84	13.12	-15.96	- 60.2	-1.128	2.20	10.92
-3.13	19.64	-22.77	-177.6	4.624	-6.13	25.77
-3.13	15.69	-18.82	-168.2	0.062	-0.10	15.79
-3.13	12.44	-15.57	-137.1	-1.536	3.27	9.17
-3.13	10.36	-13.49	- 67.5	-1.893	5.15	5.21
-3.28	18.25	-21.53	-313.8	2.206	-3.23	21.48
-3.28	14.48	-17.76	-261.9	-1.074	2.04	12.44
-3.28	11.40	-14.68	-190.5	-1.924	4.82	6.58
-2.68	20.19	-22.87	-433.4	4.805	-1.53	21.72
-2.68	16.39	-19.07	-381.4	-0.243	0.42	15.97
-2.68	12.92	-15.60	-296.0	-1.883	4.42	8.50
-1.54	19.63	-21.17	-517.1	3.718	-5.05	24.68
-1.54	17.73	-19.27	-481.3	0.745	-1.18	18.91
-1.54	14.35	-15.89	-392.9	-1.694	3.72	10.63
0.55	15.17	-15.72	-465.7	-1.465	3.06	12.11
-0.09	10.17	-10.26	-303.9	-0.956	8.26	1.91
0.55	9.41	- 8.86	-219.1	-0.944	6.78	2.63
-0.09	7.94	- 8.03	-200.5	0.310	8.51	-0.57
0.19	7.31	- 7.12	-173.9	1.250	8.82	-1.51
-1.54	8.57	-10.11	-191.8	-1.220	7.24	1.33
0.55	7.16	- 6.61	-132.2	-0.084	6.46	0.70
-0.09	6.04	- 6.13	-116.2	1.288	7.83	-1.79
-2.68	8.25	-10.93	-141.8	-1.433	7.34	0.91
-1.54	7.02	- 8.56	-126.3	-0.517	7.57	-0.55
0.55	5.86	- 5.31	- 77.4	0.544	6.11	-0.25
-3.28	8.75	-12.03	- 60.2	-1.688	7.44	1.31
-2.68	7.68	-10.36	- 91.2	-1.022	8.16	-0.50
-1.54	6.59	- 8.13	- 81.3	0.027	8.30	-1.71
0.55	5.63	- 5.08	- 39.6	1.032	6.45	-0.82
-2.68	7.57	-10.25	- 38.7	-0.724	8.83	-1.26
-1.54	6.58	- 8.12	- 36.9	0.404	8.75	-2.17

[illegible]

TABLE XXVI—Continued

Lens 18						
ϕ_1	ϕ_2	$\phi_1 - \phi_2$	DV	dX''	$f dX'' / z_{a2}$	e_o
(m)	(m)	(m)	(microns)	(m)	(m)	(m)
0.56	-2.05	2.61	11.9	-0.130	0.20	-2.25
0.56	-2.00	2.56	9.7	0.181	-0.35	-1.65
0.33	-2.30	2.63	20.5	-0.534	0.71	-3.01
0.33	-1.96	2.29	22.9	-0.007	0.01	-1.97
0.33	-1.92	2.15	18.9	0.212	-0.45	-1.47
0.33	-1.75	2.08	10.4	0.292	-0.79	-0.96
0.20	-2.14	2.34	34.1	-0.240	0.35	-2.49
0.20	-1.82	2.02	29.8	0.122	-0.23	-1.59
0.20	-1.80	2.00	26.0	0.262	-0.66	-1.14
0.20	-2.46	2.66	50.4	-0.559	0.74	-3.20
0.20	-1.93	2.13	42.6	0.027	-0.05	-1.88
0.20	-1.65	1.85	35.1	0.223	-0.52	-1.13
0	-2.50	2.50	61.1	-0.439	0.60	-3.10
0	-2.18	2.18	54.4	-0.084	0.13	-2.31
0	-1.70	1.70	42.0	0.184	-0.40	-1.30
0	-1.89	1.89	56.0	0.176	-0.37	-1.52
-0.15	-1.22	1.07	31.7	0.100	-0.86	-0.36
0	-1.25	1.25	30.9	0.133	-0.95	-0.30
-0.15	-1.08	0.93	23.2	-0.036	-0.99	-0.09
-0.24	-1.01	0.77	18.8	-0.135	-0.95	-0.06
0	-1.48	1.48	28.1	0.179	-1.06	-0.42
0	-1.32	1.32	26.4	0.017	-1.31	-0.01
-0.15	-1.19	1.04	19.7	-0.219	-1.33	0.14
-0.20	-0.98	0.78	10.1	0.102	-0.52	-0.46
0	-1.37	1.37	20.2	0.083	-1.21	-0.16
0	-1.24	1.24	18.1	-0.127	-1.42	0.18
-0.20	-1.02	0.82	4.1	0.115	-0.51	-0.51
-0.20	-0.90	0.70	6.2	0.069	-0.55	-0.35
0	-0.78	0.78	7.8	-0.003	-0.92	0.14
0	-0.67	0.67	5.2	-0.136	-0.85	0.18
-0.20	-0.63	0.43	1.6	0.030	-0.37	-0.26
0	-0.51	0.51	2.3	-0.001	-0.02	-0.49

EXPERIMENTAL DATA

42 mm						
λ	λ_{vac}	λ_{air}	λ_{eff}	λ_{eff}	λ_{eff}	λ_{eff}
(μ)	(μ)	(μ)	(microns)	(μ)	(μ)	(μ)
4.0	4.0	4.0	4.0	4.0	4.0	4.0
4.1	4.1	4.1	4.1	4.1	4.1	4.1
4.2	4.2	4.2	4.2	4.2	4.2	4.2
4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.4	4.4	4.4	4.4	4.4	4.4	4.4
4.5	4.5	4.5	4.5	4.5	4.5	4.5
4.6	4.6	4.6	4.6	4.6	4.6	4.6
4.7	4.7	4.7	4.7	4.7	4.7	4.7
4.8	4.8	4.8	4.8	4.8	4.8	4.8
4.9	4.9	4.9	4.9	4.9	4.9	4.9
5.0	5.0	5.0	5.0	5.0	5.0	5.0
5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.2	5.2	5.2	5.2	5.2	5.2	5.2
5.3	5.3	5.3	5.3	5.3	5.3	5.3
5.4	5.4	5.4	5.4	5.4	5.4	5.4
5.5	5.5	5.5	5.5	5.5	5.5	5.5
5.6	5.6	5.6	5.6	5.6	5.6	5.6
5.7	5.7	5.7	5.7	5.7	5.7	5.7
5.8	5.8	5.8	5.8	5.8	5.8	5.8
5.9	5.9	5.9	5.9	5.9	5.9	5.9
6.0	6.0	6.0	6.0	6.0	6.0	6.0
6.1	6.1	6.1	6.1	6.1	6.1	6.1
6.2	6.2	6.2	6.2	6.2	6.2	6.2
6.3	6.3	6.3	6.3	6.3	6.3	6.3
6.4	6.4	6.4	6.4	6.4	6.4	6.4
6.5	6.5	6.5	6.5	6.5	6.5	6.5
6.6	6.6	6.6	6.6	6.6	6.6	6.6
6.7	6.7	6.7	6.7	6.7	6.7	6.7
6.8	6.8	6.8	6.8	6.8	6.8	6.8
6.9	6.9	6.9	6.9	6.9	6.9	6.9
7.0	7.0	7.0	7.0	7.0	7.0	7.0
7.1	7.1	7.1	7.1	7.1	7.1	7.1
7.2	7.2	7.2	7.2	7.2	7.2	7.2
7.3	7.3	7.3	7.3	7.3	7.3	7.3
7.4	7.4	7.4	7.4	7.4	7.4	7.4
7.5	7.5	7.5	7.5	7.5	7.5	7.5
7.6	7.6	7.6	7.6	7.6	7.6	7.6
7.7	7.7	7.7	7.7	7.7	7.7	7.7
7.8	7.8	7.8	7.8	7.8	7.8	7.8
7.9	7.9	7.9	7.9	7.9	7.9	7.9
8.0	8.0	8.0	8.0	8.0	8.0	8.0
8.1	8.1	8.1	8.1	8.1	8.1	8.1
8.2	8.2	8.2	8.2	8.2	8.2	8.2
8.3	8.3	8.3	8.3	8.3	8.3	8.3
8.4	8.4	8.4	8.4	8.4	8.4	8.4
8.5	8.5	8.5	8.5	8.5	8.5	8.5
8.6	8.6	8.6	8.6	8.6	8.6	8.6
8.7	8.7	8.7	8.7	8.7	8.7	8.7
8.8	8.8	8.8	8.8	8.8	8.8	8.8
8.9	8.9	8.9	8.9	8.9	8.9	8.9
9.0	9.0	9.0	9.0	9.0	9.0	9.0
9.1	9.1	9.1	9.1	9.1	9.1	9.1
9.2	9.2	9.2	9.2	9.2	9.2	9.2
9.3	9.3	9.3	9.3	9.3	9.3	9.3
9.4	9.4	9.4	9.4	9.4	9.4	9.4
9.5	9.5	9.5	9.5	9.5	9.5	9.5
9.6	9.6	9.6	9.6	9.6	9.6	9.6
9.7	9.7	9.7	9.7	9.7	9.7	9.7
9.8	9.8	9.8	9.8	9.8	9.8	9.8
9.9	9.9	9.9	9.9	9.9	9.9	9.9
10.0	10.0	10.0	10.0	10.0	10.0	10.0

TABLE XXVI—Continued

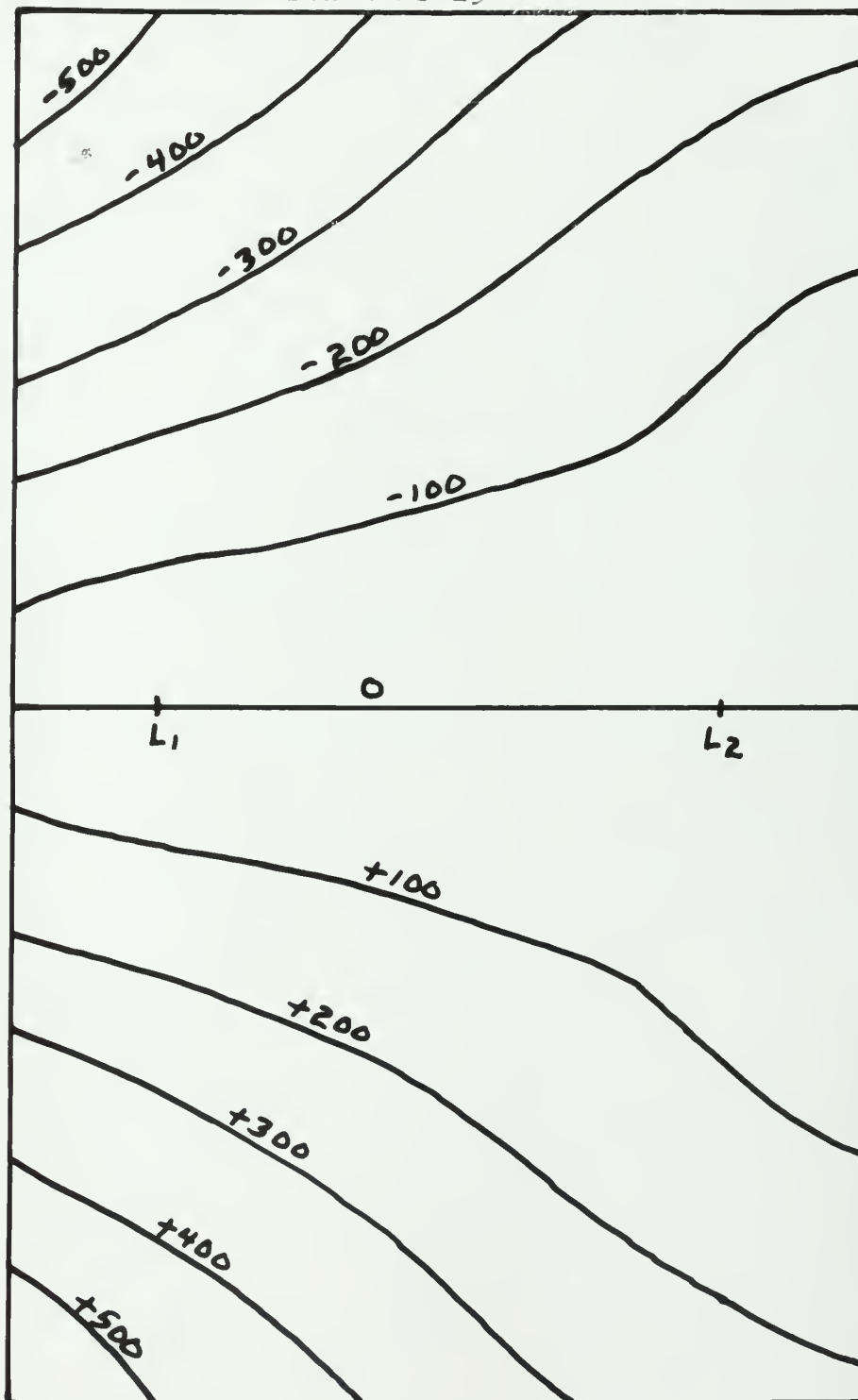
Average						
ϕ_1	ϕ_2	$\phi_1 - \phi_2$	ρy	dx''	$f dx''/x_{s_2}$	ϕ_0
(m)	(m)	(m)	(microns)	(m)	(m)	(m)
-0.54	-1.24	0.70	3.2	-0.035	0.05	-1.29
-0.54	-1.62	1.08	4.1	0.076	-0.15	-1.47
-0.58	-1.10	0.52	4.1	-0.106	0.14	-1.24
-0.58	-1.19	0.61	6.1	-0.002	0	-1.19
-0.58	-1.57	0.99	8.7	0.098	-0.21	-1.36
-0.58	-1.72	1.14	5.7	0.160	-0.43	-1.29
-0.80	-1.00	0.20	2.9	-0.021	0.03	-1.03
-0.80	-1.10	0.30	4.4	0.018	-0.03	-1.07
-0.80	-1.50	0.70	9.1	0.092	-0.23	-1.27
-0.55	-1.49	0.94	17.8	-0.198	0.26	-1.75
-0.55	-0.88	0.33	6.6	0.004	-0.01	-0.87
-0.55	-1.00	0.45	8.5	0.054	-0.13	-0.87
-0.02	-1.66	1.64	40.1	-0.289	0.39	-2.05
-0.02	-1.33	1.31	32.7	-0.051	0.08	-1.41
-0.02	-0.74	0.72	17.8	0.078	-0.17	-0.57
0.27	-1.15	1.42	42.1	0.133	-0.28	-0.87
-0.12	-0.46	0.34	10.1	0.032	-0.28	-0.18
0.27	-0.76	1.03	25.5	0.110	-0.79	0.03
-0.12	-0.66	0.54	13.5	-0.021	-0.58	-0.08
-0.32	-0.62	0.30	7.3	-0.053	-0.37	-0.25
-0.02	-1.15	1.13	21.4	0.137	-0.81	-0.31
0.27	-1.22	1.49	29.8	0.019	-1.46	0.24
-0.12	-1.14	1.02	19.3	-0.215	-1.30	0.16
-0.55	-1.58	1.03	13.4	0.135	-0.69	-0.89
-0.02	-1.50	1.48	21.8	0.090	-1.32	-0.18
0.27	-1.42	1.69	24.6	-0.174	-1.95	0.53
-0.80	-1.38	0.58	2.9	0.082	-0.36	-1.02
-0.55	-1.31	0.76	6.7	0.075	-0.60	-0.71
-0.02	-1.25	1.23	12.3	-0.004	-1.23	-0.02
0.27	-1.17	1.44	11.2	-0.293	-1.83	0.66
-0.55	-1.25	0.70	2.6	0.050	-0.61	-0.64
-0.02	-1.27	1.25	5.7	-0.062	-1.34	0.07

TABLE 1. SUMMARY OF DATA

STATION						
STATION	DATE	TIME	WIND	WAVE	WAVE	WAVE
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1/1/74	10:00	10.0	1.0	1.0	1.0
2	1/1/74	11:00	11.0	1.1	1.1	1.1
3	1/1/74	12:00	12.0	1.2	1.2	1.2
4	1/1/74	13:00	13.0	1.3	1.3	1.3
5	1/1/74	14:00	14.0	1.4	1.4	1.4
6	1/1/74	15:00	15.0	1.5	1.5	1.5
7	1/1/74	16:00	16.0	1.6	1.6	1.6
8	1/1/74	17:00	17.0	1.7	1.7	1.7
9	1/1/74	18:00	18.0	1.8	1.8	1.8
10	1/1/74	19:00	19.0	1.9	1.9	1.9
11	1/1/74	20:00	20.0	2.0	2.0	2.0
12	1/1/74	21:00	21.0	2.1	2.1	2.1
13	1/1/74	22:00	22.0	2.2	2.2	2.2
14	1/1/74	23:00	23.0	2.3	2.3	2.3
15	1/1/74	24:00	24.0	2.4	2.4	2.4
16	1/1/74	25:00	25.0	2.5	2.5	2.5
17	1/1/74	26:00	26.0	2.6	2.6	2.6
18	1/1/74	27:00	27.0	2.7	2.7	2.7
19	1/1/74	28:00	28.0	2.8	2.8	2.8
20	1/1/74	29:00	29.0	2.9	2.9	2.9
21	1/1/74	30:00	30.0	3.0	3.0	3.0
22	1/1/74	31:00	31.0	3.1	3.1	3.1
23	1/1/74	32:00	32.0	3.2	3.2	3.2
24	1/1/74	33:00	33.0	3.3	3.3	3.3
25	1/1/74	34:00	34.0	3.4	3.4	3.4
26	1/1/74	35:00	35.0	3.5	3.5	3.5
27	1/1/74	36:00	36.0	3.6	3.6	3.6
28	1/1/74	37:00	37.0	3.7	3.7	3.7
29	1/1/74	38:00	38.0	3.8	3.8	3.8
30	1/1/74	39:00	39.0	3.9	3.9	3.9
31	1/1/74	40:00	40.0	4.0	4.0	4.0
32	1/1/74	41:00	41.0	4.1	4.1	4.1
33	1/1/74	42:00	42.0	4.2	4.2	4.2
34	1/1/74	43:00	43.0	4.3	4.3	4.3
35	1/1/74	44:00	44.0	4.4	4.4	4.4
36	1/1/74	45:00	45.0	4.5	4.5	4.5
37	1/1/74	46:00	46.0	4.6	4.6	4.6
38	1/1/74	47:00	47.0	4.7	4.7	4.7
39	1/1/74	48:00	48.0	4.8	4.8	4.8
40	1/1/74	49:00	49.0	4.9	4.9	4.9
41	1/1/74	50:00	50.0	5.0	5.0	5.0
42	1/1/74	51:00	51.0	5.1	5.1	5.1
43	1/1/74	52:00	52.0	5.2	5.2	5.2
44	1/1/74	53:00	53.0	5.3	5.3	5.3
45	1/1/74	54:00	54.0	5.4	5.4	5.4
46	1/1/74	55:00	55.0	5.5	5.5	5.5
47	1/1/74	56:00	56.0	5.6	5.6	5.6
48	1/1/74	57:00	57.0	5.7	5.7	5.7
49	1/1/74	58:00	58.0	5.8	5.8	5.8
50	1/1/74	59:00	59.0	5.9	5.9	5.9
51	1/1/74	60:00	60.0	6.0	6.0	6.0
52	1/1/74	61:00	61.0	6.1	6.1	6.1
53	1/1/74	62:00	62.0	6.2	6.2	6.2
54	1/1/74	63:00	63.0	6.3	6.3	6.3
55	1/1/74	64:00	64.0	6.4	6.4	6.4
56	1/1/74	65:00	65.0	6.5	6.5	6.5
57	1/1/74	66:00	66.0	6.6	6.6	6.6
58	1/1/74	67:00	67.0	6.7	6.7	6.7
59	1/1/74	68:00	68.0	6.8	6.8	6.8
60	1/1/74	69:00	69.0	6.9	6.9	6.9
61	1/1/74	70:00	70.0	7.0	7.0	7.0
62	1/1/74	71:00	71.0	7.1	7.1	7.1
63	1/1/74	72:00	72.0	7.2	7.2	7.2
64	1/1/74	73:00	73.0	7.3	7.3	7.3
65	1/1/74	74:00	74.0	7.4	7.4	7.4
66	1/1/74	75:00	75.0	7.5	7.5	7.5
67	1/1/74	76:00	76.0	7.6	7.6	7.6
68	1/1/74	77:00	77.0	7.7	7.7	7.7
69	1/1/74	78:00	78.0	7.8	7.8	7.8
70	1/1/74	79:00	79.0	7.9	7.9	7.9
71	1/1/74	80:00	80.0	8.0	8.0	8.0
72	1/1/74	81:00	81.0	8.1	8.1	8.1
73	1/1/74	82:00	82.0	8.2	8.2	8.2
74	1/1/74	83:00	83.0	8.3	8.3	8.3
75	1/1/74	84:00	84.0	8.4	8.4	8.4
76	1/1/74	85:00	85.0	8.5	8.5	8.5
77	1/1/74	86:00	86.0	8.6	8.6	8.6
78	1/1/74	87:00	87.0	8.7	8.7	8.7
79	1/1/74	88:00	88.0	8.8	8.8	8.8
80	1/1/74	89:00	89.0	8.9	8.9	8.9
81	1/1/74	90:00	90.0	9.0	9.0	9.0
82	1/1/74	91:00	91.0	9.1	9.1	9.1
83	1/1/74	92:00	92.0	9.2	9.2	9.2
84	1/1/74	93:00	93.0	9.3	9.3	9.3
85	1/1/74	94:00	94.0	9.4	9.4	9.4
86	1/1/74	95:00	95.0	9.5	9.5	9.5
87	1/1/74	96:00	96.0	9.6	9.6	9.6
88	1/1/74	97:00	97.0	9.7	9.7	9.7
89	1/1/74	98:00	98.0	9.8	9.8	9.8
90	1/1/74	99:00	99.0	9.9	9.9	9.9
91	1/1/74	100:00	100.0	10.0	10.0	10.0
92	1/1/74	101:00	101.0	10.1	10.1	10.1
93	1/1/74	102:00	102.0	10.2	10.2	10.2
94	1/1/74	103:00	103.0	10.3	10.3	10.3
95	1/1/74	104:00	104.0	10.4	10.4	10.4
96	1/1/74	105:00	105.0	10.5	10.5	10.5
97	1/1/74	106:00	106.0	10.6	10.6	10.6
98	1/1/74	107:00	107.0	10.7	10.7	10.7
99	1/1/74	108:00	108.0	10.8	10.8	10.8
100	1/1/74	109:00	109.0	10.9	10.9	10.9
101	1/1/74	110:00	110.0	11.0	11.0	11.0
102	1/1/74	111:00	111.0	11.1	11.1	11.1
103	1/1/74	112:00	112.0	11.2	11.2	11.2
104	1/1/74	113:00	113.0	11.3	11.3	11.3
105	1/1/74	114:00	114.0	11.4	11.4	11.4
106	1/1/74	115:00	115.0	11.5	11.5	11.5
107	1/1/74	116:00	116.0	11.6	11.6	11.6
108	1/1/74	117:00	117.0	11.7	11.7	11.7
109	1/1/74	118:00	118.0	11.8	11.8	11.8
110	1/1/74	119:00	119.0	11.9	11.9	11.9
111	1/1/74	120:00	120.0	12.0	12.0	12.0
112	1/1/74	121:00	121.0	12.1	12.1	12.1
113	1/1/74	122:00	122.0	12.2	12.2	12.2
114	1/1/74	123:00	123.0	12.3	12.3	12.3
115	1/1/74	124:00	124.0	12.4	12.4	12.4
116	1/1/74	125:00	125.0	12.5	12.5	12.5
117	1/1/74	126:00	126.0	12.6	12.6	12.6
118	1/1/74	127:00	127.0	12.7	12.7	12.7
119	1/1/74	128:00	128.0	12.8	12.8	12.8
120	1/1/74	129:00	129.0	12.9	12.9	12.9
121	1/1/74	130:00	130.0	13.0	13.0	13.0
122	1/1/74	131:00	131.0	13.1	13.1	13.1
123	1/1/74	132:00	132.0	13.2	13.2	13.2
124	1/1/74	133:00	133.0	13.3	13.3	13.3
125	1/1/74	134:00	134.0	13.4	13.4	13.4
126	1/1/74	135:00	135.0	13.5	13.5	13.5
127	1/1/74	136:00	136.0	13.6	13.6	13.6
128	1/1/74	137:00	137.0	13.7	13.7	13.7
129	1/1/74	138:00	138.0	13.8	13.8	13.8
130	1/1/74	139:00	139.0	13.9	13.9	13.9
131	1/1/74	140:00	140.0	14.0	14.0	14.0
132	1/1/74	141:00	141.0	14.1	14.1	14.1
133	1/1/74	142:00	142.0	14.2	14.2	14.2
134	1/1/74	143:00	143.0	14.3	14.3	14.3
135	1/1/74	144:00	144.0	14.4	14.4	14.4
136	1/1/74	145:00	145.0	14.5	14.5	14.5
137	1/1/74	146:00	146.0	14.6	14.6	14.6
138	1/1/74	147:00	147.0	14.7	14.7	14.7
139	1/1/74	148:00	148.0	14.8	14.8	14.8
140	1/1/74	149:00	149.0	14.9	14.9	14.9
141	1/1/74	150:00	150.0	15.0	15.0	15.0
142	1/1/74	151:00	151.0	15.1	15.1	15.1
143	1/1/74	152:00	152.0	15.2	15.2	15.2
144	1/1/74	153:00	153.0	15.3	15.3	15.3
145	1/1/74	154:00	154.0	15.4	15.4	15.4
146	1/1/74	155:00	155.0	15.5	15.5	15.5
147	1/1/74	156:00	156.0	15.6	15.6	15.6
148	1/1/74	157:00	157.0	15.7	15.7	15.7
149	1/1/74	158:00	158.0	15.8	15.8	15.8
150	1/1/74	159:00	159.0	15.9	15.9	15.9
151	1/1/74	160:00	160.0	16.0	16.0	16.0
152	1/1/74	161:00	161.0	16.1	16.1	16.1
153	1/1/74	162:00	162.0	16.2	16.2	16.2
154	1/1/74	163:00	163.0	16.3	16.3	16.3
155	1/1/74	164:00	164.0	16.4	16.4	16.4
156	1/1/74	165:00	165.0	16.5	16.5	16.5
157	1/1/74	166:00	166.0	16.6	16.6	16.6
158	1/1/74	167:00	167.0	16.7	16.7	16.7
159	1/1/74	168:00	168.0	16.8	16.8	16.8
160	1/1/74	169:00	169.0	16.9	16.9	16.9
161	1/1/74	170:00	170.0	17.0	17.0	17.0
162	1/1/74	171:00	171.0	17.1	17.1	17.1
163	1/1/74	172:00	172.0	17.2	17.2	17.2
164	1/1/74	173:00	173.0	17.3	17.3	17.3
165	1/1/74	174:00	174.0	17.4	17.4	17.4
166	1/1/74	175:00	175.0	17.5	17.5	17.5
167	1/1/74	176:00	176.0	17.6	17.6	17.6
168	1/1/74	177:00	177.0	17.7	17.7	17.7
169	1/1/74	178:00	178.0	17.8	17.8	17.8
170	1/1/74	179:00	179.0	17.9	17.9	17.9
171	1/1/74	180:00	180.0	18.0	18.0	18.0
172	1/1/74	181:00	181.0	18.1	18.1	18.1
173	1/1/74	182:00	182.0	18.2	18.2	18.2
174	1/1/74	183:00				

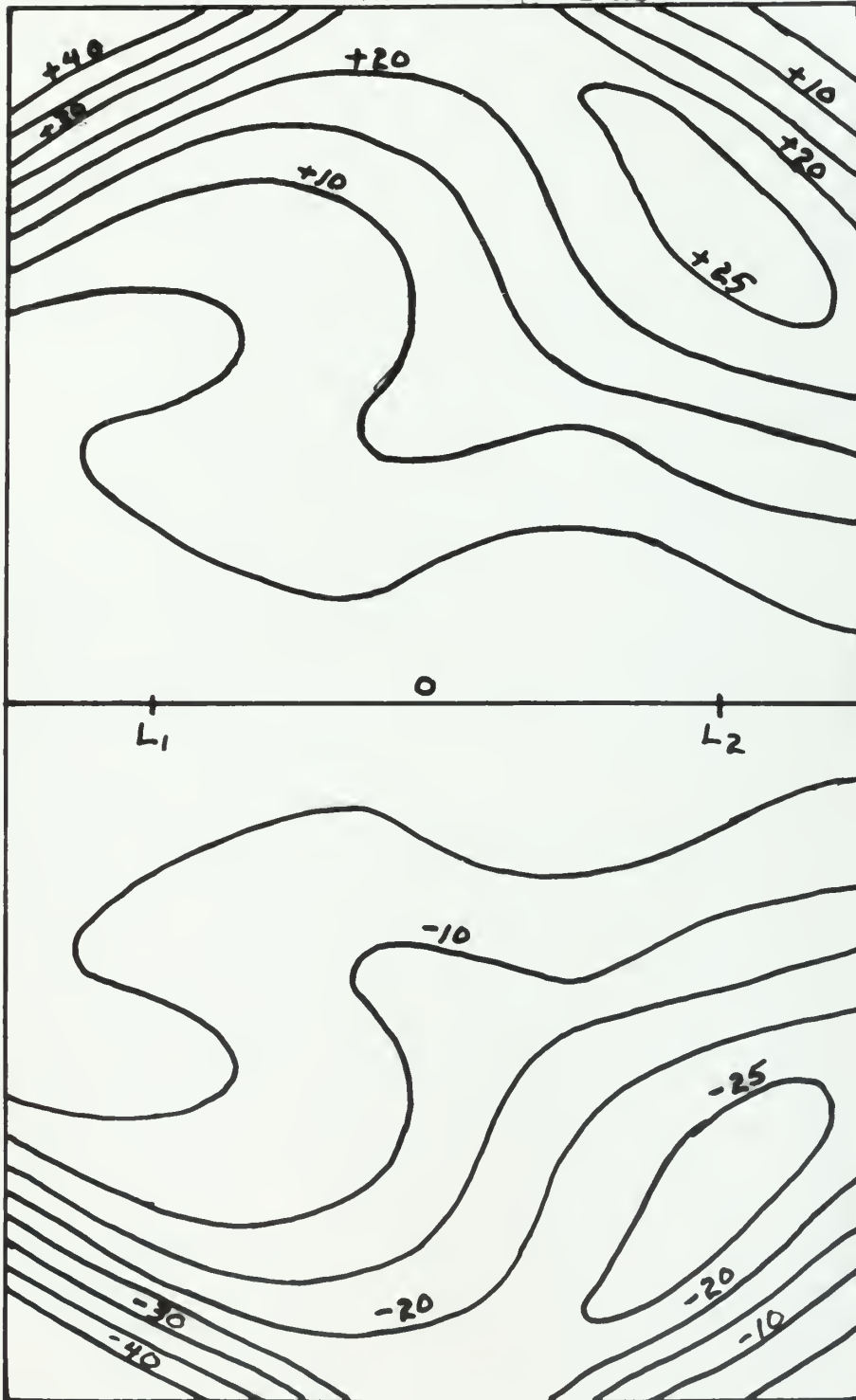
Figure 21

Y-parallax in microns
Model formed with lens 13



Y-Parallax in microns

Model formed with the average lens



Y-Parallax in microns
Model formed with lens 1

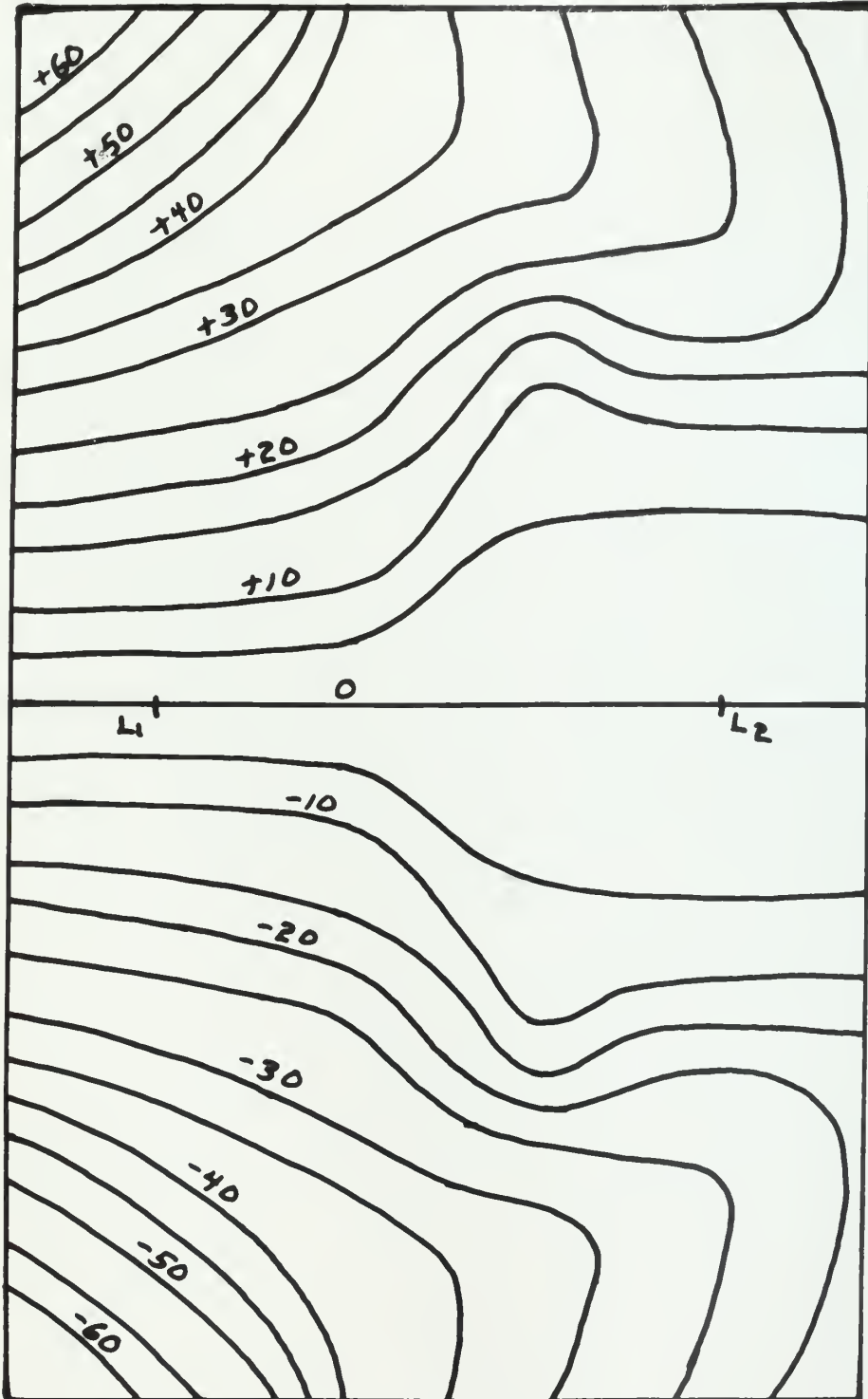
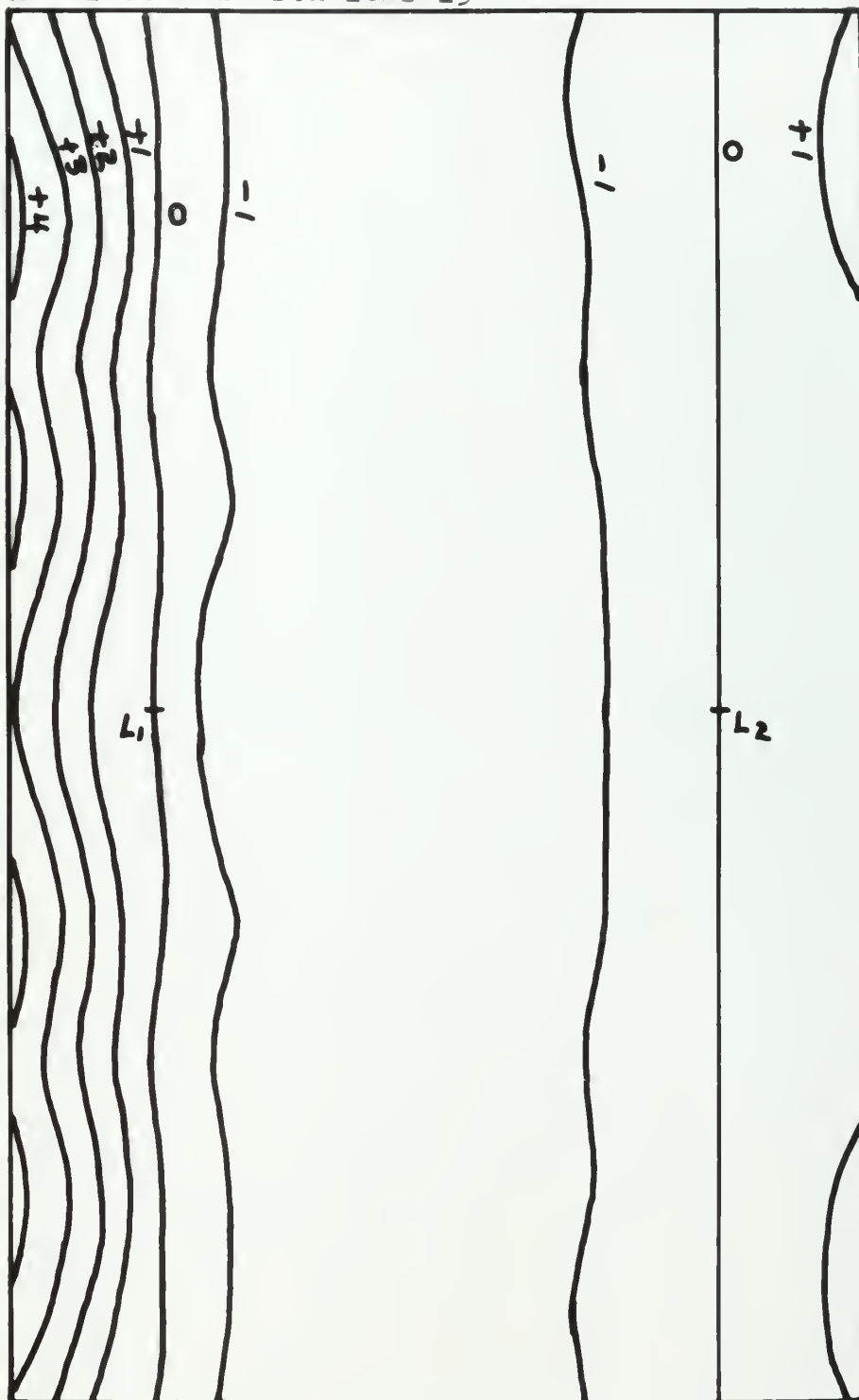
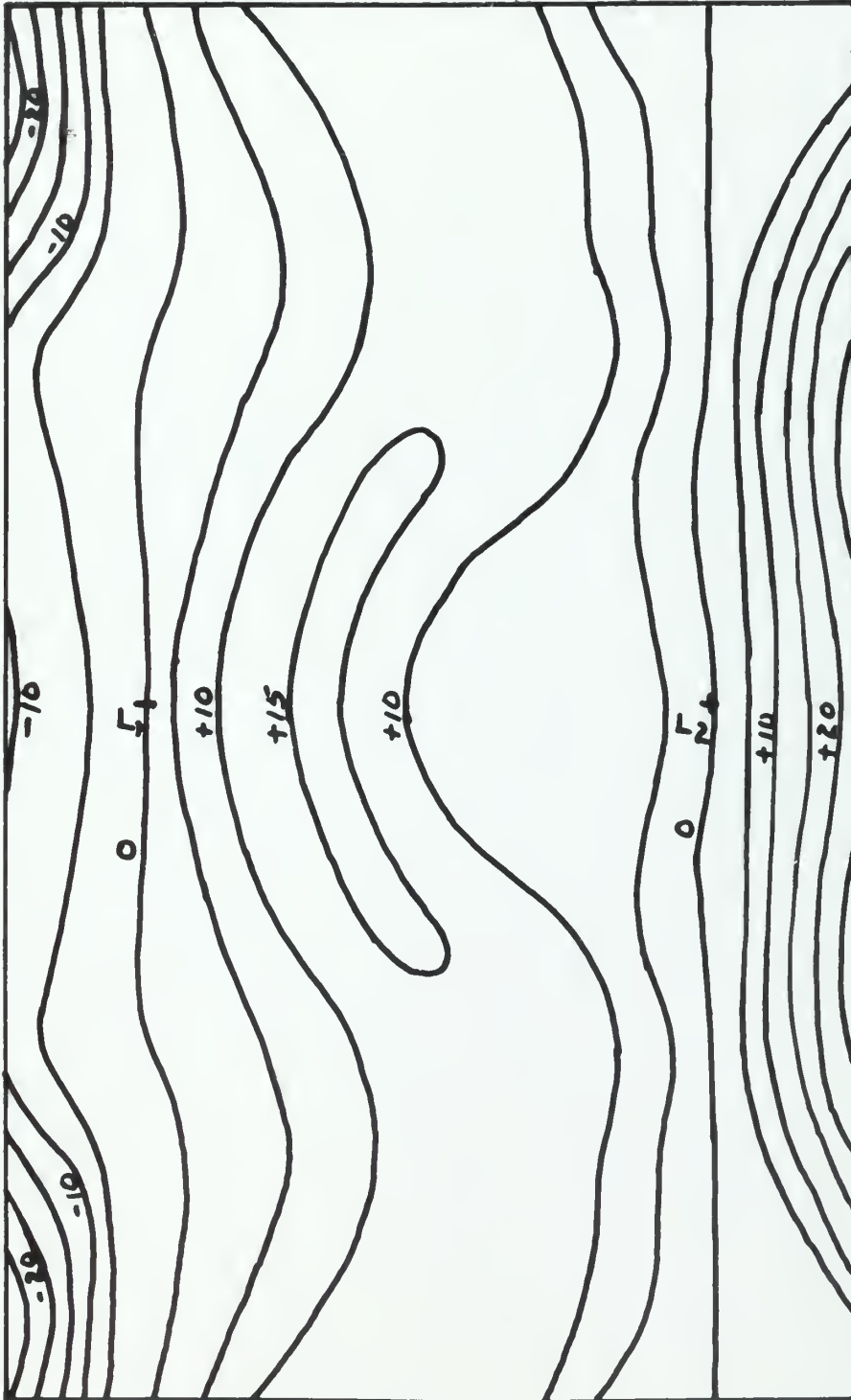


Figure 24

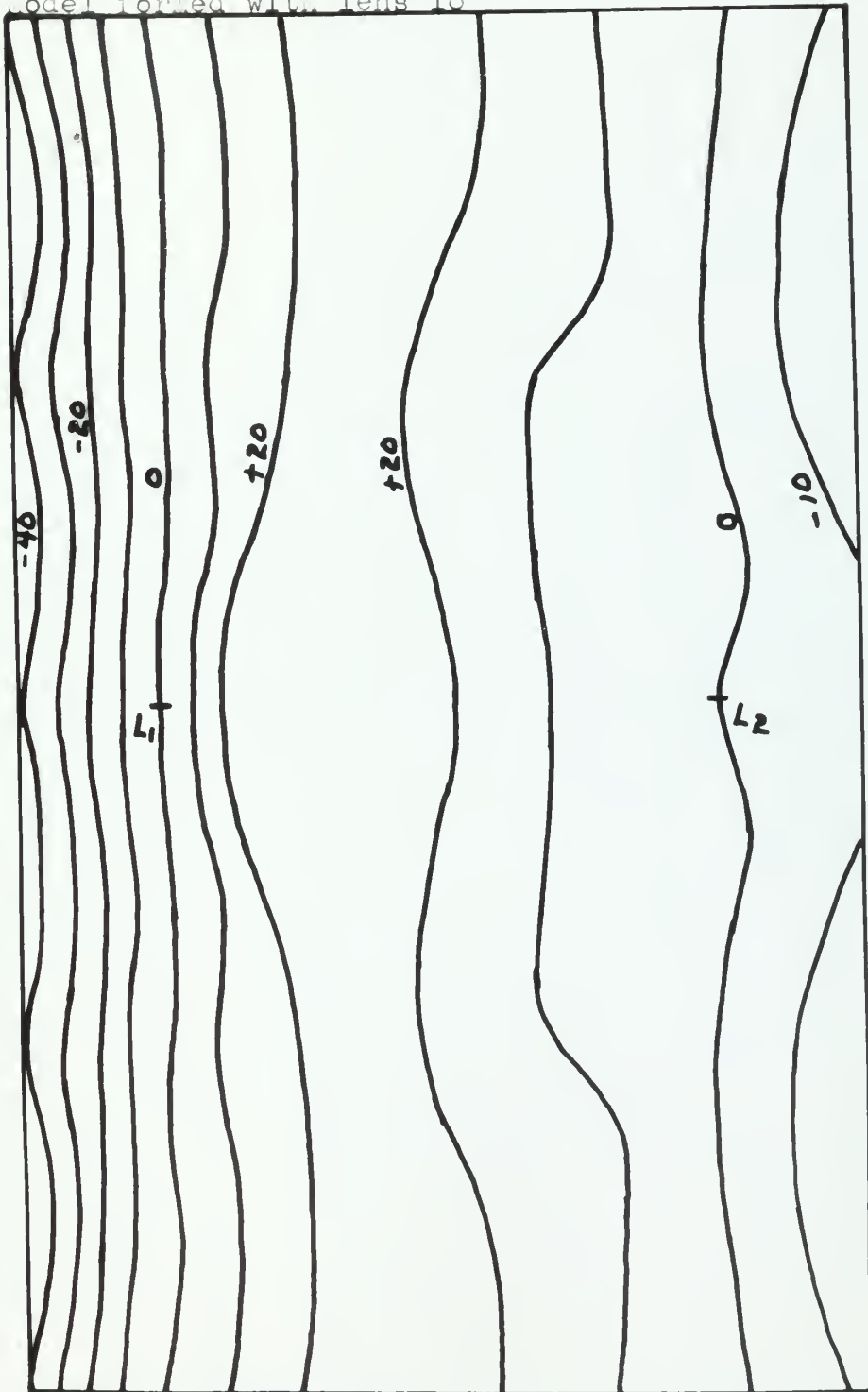
X-direction errors in meters
Model formed with lens 13



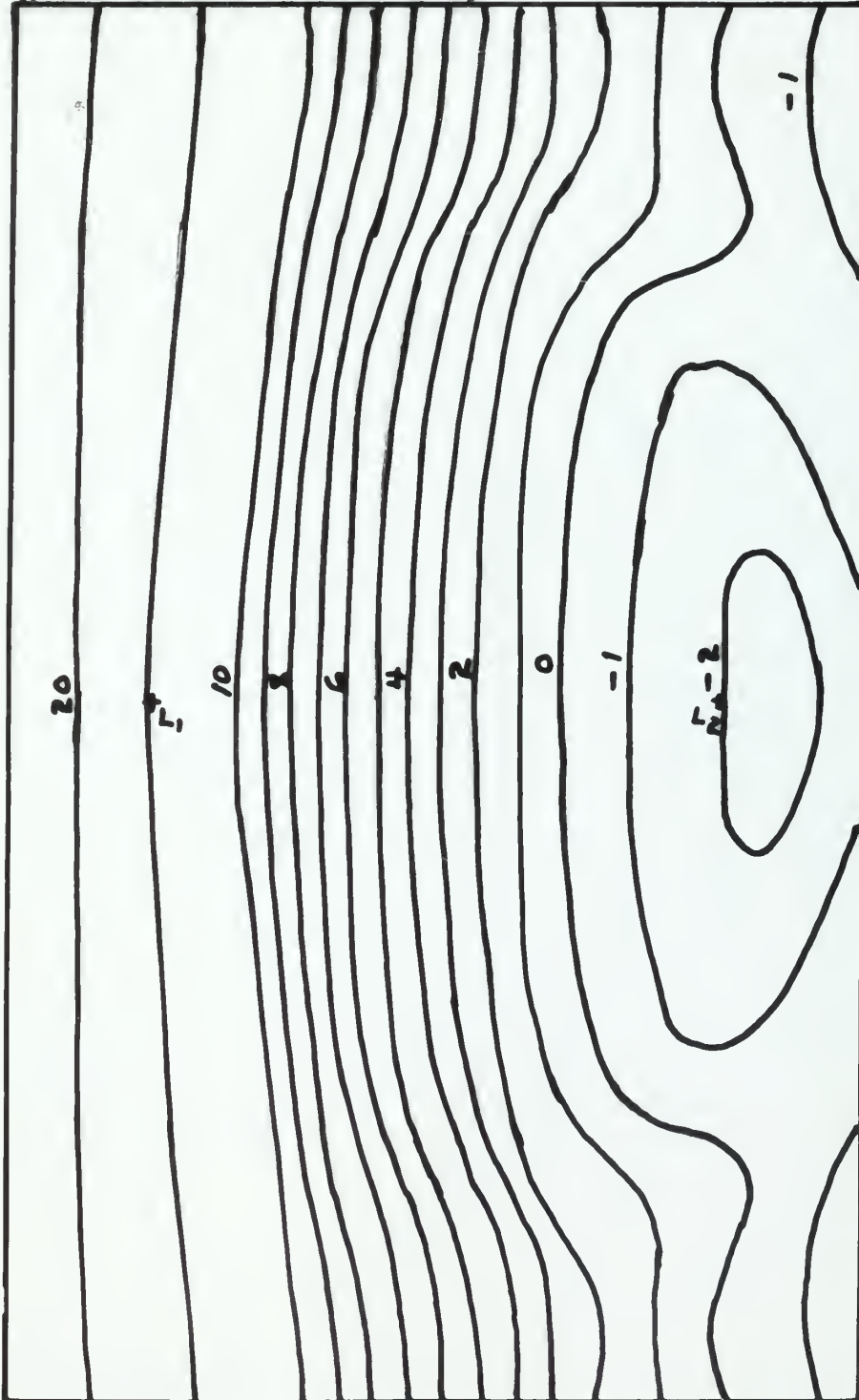
λ -direction errors in centimeters
Model formed with the average lens



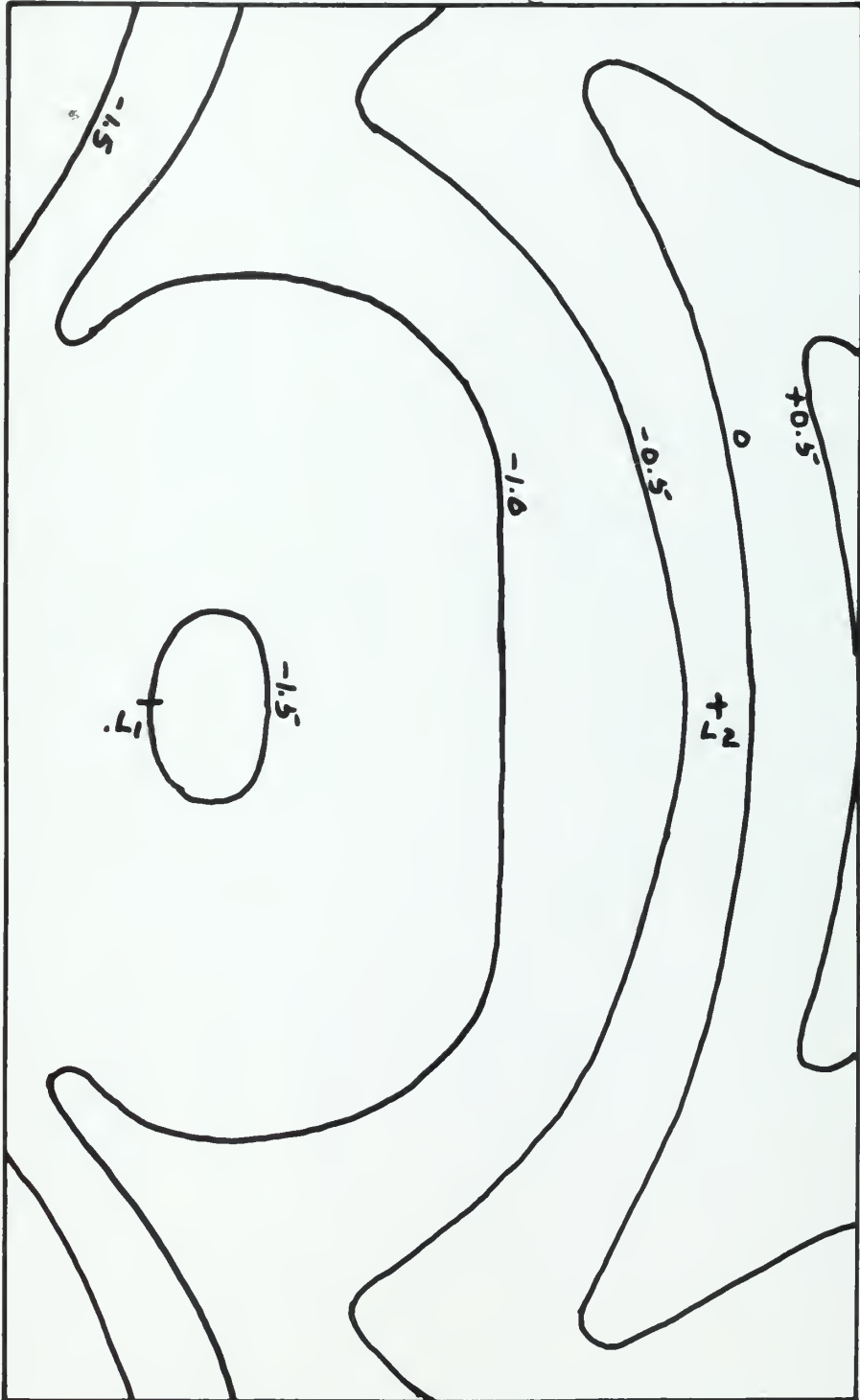
A-direction errors in centimeters
Model forced with lens 18



Elevation errors in meters
Model formed with lens 13



elevation errors in meters
Model formed with the average lens



Elevation errors in meters
Model Formed with lens 18

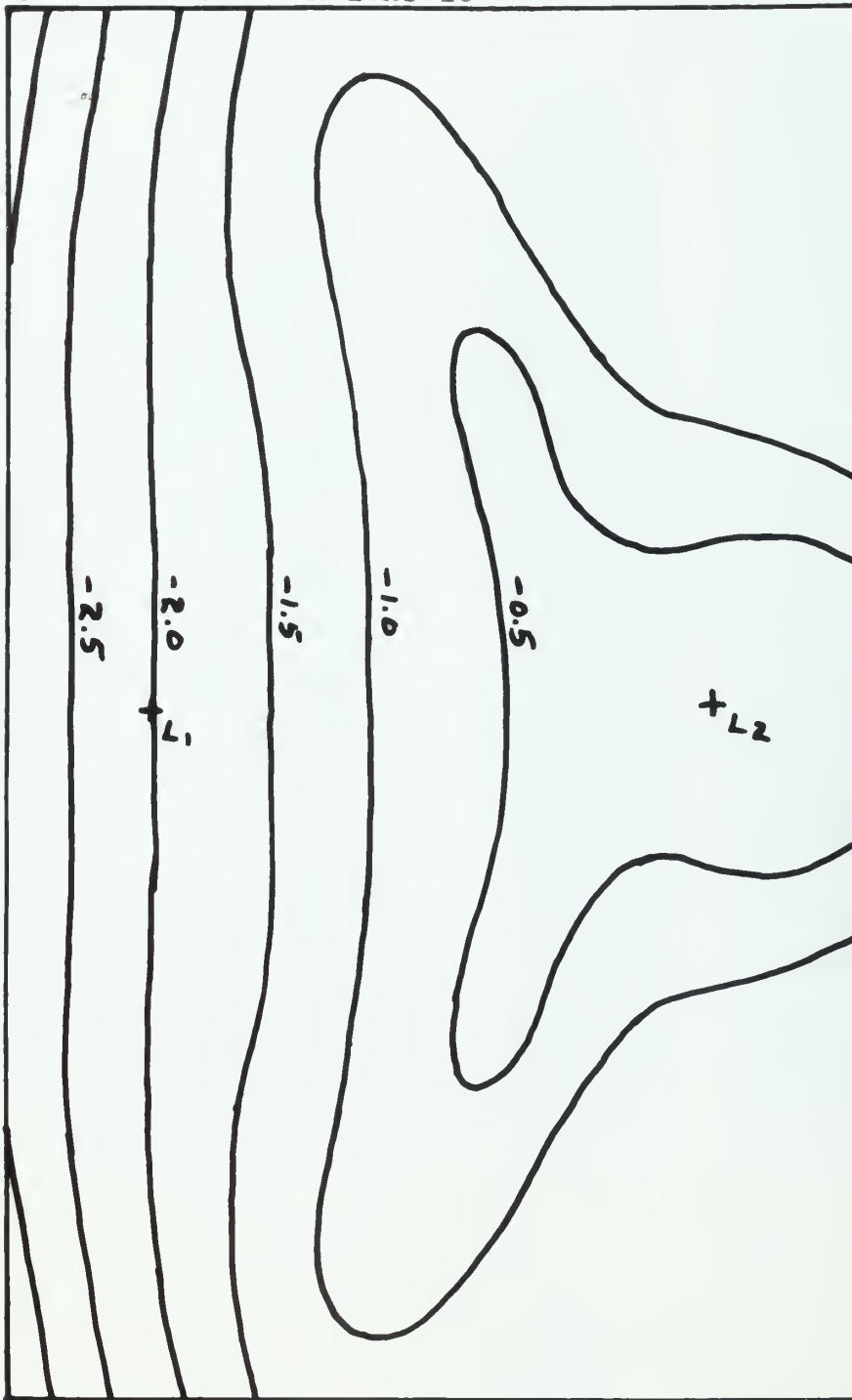


TABLE XXVII

	X(E)	Given in Feet	
		Y(N)	Z
Spro	1,593,463.81	604,404.94	684.8
Garner	1,593,451.33	603,023.15	686.2
Albert	1,594,756.93	603,076.95	685.3
Hoef	1,593,453.70	601,744.91	686.5
Weasel	1,593,375.11	600,236.17	694.5
Sarah	1,593,442.88	599,093.65	692.0
Young	1,594,738.14	599,159.21	692.3
School	1,593,438.27	597,797.52	693.0
Seigfred	1,593,421.23	595,098.23	692.4
Gentes	1,593,406.32	593,761.58	693.7
Dickmender	1,596,071.06	597,814.30	690.1
Fresse	1,597,404.30	597,760.06	690.1
Hastedt	1,598,651.10	593,773.10	694.5
John	1,598,740.74	595,063.89	692.3
Field	1,598,749.86	596,380.53	691.6
Fickle	1,598,754.96	597,752.22	690.6
Niekmeier	1,600,361.16	597,694.69	693.4
Alvah	1,601,378.97	597,752.70	691.8
Austin	1,598,690.78	598,893.28	689.2
Rich	1,598,810.24	600,368.86	687.1
Thompson	1,598,758.48	601,701.38	685.9
Richard	1,598,684.02	603,122.47	685.4
Florence	1,598,786.36	604,340.80	687.0
Blue	1,602,746.73	602,984.10	684.8
Meyers	1,604,049.62	604,317.81	683.9
H-116	1,604,103.93	603,038.92	684.9
Rowland	1,604,025.50	601,508.11	685.5
Fuller	1,604,018.30	600,357.58	686.7
Father	1,602,719.26	599,039.58	688.6
Haako	1,604,065.99	595,788.10	691.8
Winner	1,603,997.86	594,194.80	695.7
Hoskinson	1,609,391.79	600,332.56	686.9
Lange	1,593,421.79	596,401.23	693.4

2	SOUTH W. CORNER (N7)	(S12)	
1.100	10.100,100	10.100,100,1	10000
1.100	11.100,100	11.100,100,1	10000
1.100	12.100,100	12.100,100,1	10000
1.100	13.100,100	13.100,100,1	10000
1.100	14.100,100	14.100,100,1	10000
1.100	15.100,100	15.100,100,1	10000
1.100	16.100,100	16.100,100,1	10000
1.100	17.100,100	17.100,100,1	10000
1.100	18.100,100	18.100,100,1	10000
1.100	19.100,100	19.100,100,1	10000
1.100	20.100,100	20.100,100,1	10000
1.100	21.100,100	21.100,100,1	10000
1.100	22.100,100	22.100,100,1	10000
1.100	23.100,100	23.100,100,1	10000
1.100	24.100,100	24.100,100,1	10000
1.100	25.100,100	25.100,100,1	10000
1.100	26.100,100	26.100,100,1	10000
1.100	27.100,100	27.100,100,1	10000
1.100	28.100,100	28.100,100,1	10000
1.100	29.100,100	29.100,100,1	10000
1.100	30.100,100	30.100,100,1	10000
1.100	31.100,100	31.100,100,1	10000
1.100	32.100,100	32.100,100,1	10000
1.100	33.100,100	33.100,100,1	10000
1.100	34.100,100	34.100,100,1	10000
1.100	35.100,100	35.100,100,1	10000
1.100	36.100,100	36.100,100,1	10000
1.100	37.100,100	37.100,100,1	10000
1.100	38.100,100	38.100,100,1	10000
1.100	39.100,100	39.100,100,1	10000
1.100	40.100,100	40.100,100,1	10000
1.100	41.100,100	41.100,100,1	10000
1.100	42.100,100	42.100,100,1	10000
1.100	43.100,100	43.100,100,1	10000
1.100	44.100,100	44.100,100,1	10000
1.100	45.100,100	45.100,100,1	10000
1.100	46.100,100	46.100,100,1	10000
1.100	47.100,100	47.100,100,1	10000
1.100	48.100,100	48.100,100,1	10000
1.100	49.100,100	49.100,100,1	10000
1.100	50.100,100	50.100,100,1	10000

TABLE XXVII—Continued

Observed			Observed at Ground Scale in Feet	
X(E) (mm)	Y(E) (mm)	Z (ft)	E	N
808.66	1,284.24	685.1	42,133.86	26,530.84
766.57	1,283.41	684.6	42,106.63	25,149.94
769.43	1,243.66	685.1	40,802.49	25,243.77
727.62	1,282.13	685.1	42,064.63	23,872.05
681.60	1,283.16	693.1	42,098.43	22,362.21
646.83	1,280.13	688.3	41,999.02	21,221.46
650.02	1,240.74	688.8	40,706.69	21,326.12
607.32	1,279.12	686.1	41,965.88	19,925.20
525.00	1,277.16	682.8	41,901.58	17,224.41
484.26	1,276.47	684.3	41,878.94	15,887.80
610.23	1,198.90	687.7	39,333.99	20,020.67
609.75	1,158.27	689.5	38,000.99	20,004.92
489.37	1,116.75	674.2	36,638.78	16,055.45
528.84	1,115.10	695.3	36,584.65	17,350.39
568.98	1,116.03	694.5	36,615.16	18,667.32
610.77	1,117.10	694.3	36,650.26	20,038.39
610.52	1,068.17	697.2	35,044.95	20,030.18
613.19	1,037.23	695.7	34,029.86	20,117.78
645.50	1,120.08	689.3	36,748.03	21,177.82
690.60	1,117.82	686.4	36,673.89	22,657.48
731.11	1,120.60	686.7	36,765.09	23,986.55
774.38	1,124.12	684.2	36,880.58	25,406.17
811.58	1,122.16	683.7	36,816.27	26,626.64
773.90	1,000.33	686.3	32,819.23	25,390.42
815.72	961.80	681.5	31,555.12	26,762.47
776.80	959.03	686.8	31,464.24	25,485.57
730.07	959.97	684.5	31,495.08	23,952.43
695.00	959.15	685.3	31,468.18	22,801.84
653.66	997.54	690.5	32,727.69	21,445.54
555.80	953.61	699.3	31,286.42	18,234.91
507.26	954.28	707.3	31,308.40	16,642.39
699.12	795.45	689.8	26,097.44	22,937.01
564.70	1,278.31	689.2	41,939.31	18,526.90

Frequency in GHz		Wavelength		
f	λ	λ (m)	λ (cm)	λ (in)
15,000,000	20.000,00	2.000	19.685,4	77.500
16,000,000	18.750,00	1.875	18.470,5	72.717
17,000,000	17.647,06	1.765	17.359,2	68.343
18,000,000	16.667,00	1.667	16.300,0	64.173
19,000,000	15.789,47	1.579	15.309,3	60.315
20,000,000	15.000,00	1.500	14.290,0	56.250
21,000,000	14.285,71	1.429	13.368,9	52.638
22,000,000	13.636,36	1.364	12.500,0	49.213
23,000,000	13.043,48	1.304	11.678,0	45.972
24,000,000	12.500,00	1.250	10.912,7	42.927
25,000,000	12.000,00	1.200	10.193,7	40.109
26,000,000	11.538,46	1.154	9.525,8	37.500
27,000,000	11.111,11	1.111	8.908,9	35.079
28,000,000	10.714,29	1.071	8.339,3	32.812
29,000,000	10.344,83	1.034	7.812,5	30.740
30,000,000	10.000,00	1.000	7.315,6	28.811
31,000,000	9.677,42	0.968	6.846,8	27.000
32,000,000	9.375,00	0.938	6.401,7	25.297
33,000,000	9.090,91	0.909	5.978,9	23.709
34,000,000	8.823,53	0.882	5.577,1	22.222
35,000,000	8.571,43	0.857	5.194,3	20.833
36,000,000	8.333,33	0.833	4.830,9	19.528
37,000,000	8.108,11	0.811	4.485,8	18.307
38,000,000	7.894,74	0.789	4.157,9	17.161
39,000,000	7.692,31	0.769	3.846,3	16.087
40,000,000	7.500,00	0.750	3.559,3	15.079
41,000,000	7.317,07	0.732	3.294,4	14.125
42,000,000	7.142,86	0.714	3.043,5	13.190
43,000,000	6.976,74	0.698	2.805,3	12.281
44,000,000	6.818,18	0.682	2.579,3	11.396
45,000,000	6.666,67	0.667	2.364,6	10.531
46,000,000	6.521,74	0.652	2.161,2	9.690
47,000,000	6.382,98	0.638	1.968,8	8.879
48,000,000	6.250,00	0.625	1.787,6	8.099
49,000,000	6.122,45	0.612	1.616,6	7.353
50,000,000	6.000,00	0.600	1.456,8	6.646
51,000,000	5.882,35	0.588	1.308,0	6.000
52,000,000	5.769,23	0.577	1.170,1	5.413
53,000,000	5.660,38	0.566	1.042,9	4.881
54,000,000	5.555,56	0.556	9.259,3	4.401
55,000,000	5.454,55	0.545	8.242,2	3.976
56,000,000	5.357,14	0.536	7.317,1	3.604
57,000,000	5.263,16	0.526	6.479,0	3.271
58,000,000	5.172,41	0.517	5.728,4	2.978
59,000,000	5.084,75	0.508	5.055,8	2.715
60,000,000	5.000,00	0.500	4.446,3	2.480

TABLE XXVII--Continued

Observed at Given Origin		Observed at Local Origin	
E	N	E	N
1,593,304.95	604,246.30	-5,385.83	5,353.02
1,593,332.18	602,865.40	-5,358.60	3,972.12
1,594,636.32	602,959.23	-4,054.46	4,065.95
1,593,374.18	601,587.51	-5,316.60	2,694.23
1,593,340.38	600,077.67	-5,350.40	1,184.39
1,593,439.79	598,936.92	-5,250.99	43.64
1,594,732.12	599,041.58	-3,958.66	148.30
1,593,472.93	597,640.66	-5,217.85	-1,252.62
1,593,537.23	594,939.87	-5,153.55	-3,953.41
1,593,559.87	593,603.26	-5,130.91	-5,290.02
1,596,104.82	597,736.13	-2,585.96	-1,157.15
1,597,437.82	597,720.38	-1,252.96	-1,172.90
1,598,800.03	593,770.91	109.25	-5,122.37
1,598,854.16	595,065.85	163.38	-3,827.43
1,598,823.65	596,382.78	132.87	-2,510.50
1,598,788.55	597,753.85	97.77	-1,139.43
1,600,393.86	597,745.64	1,703.08	-1,147.64
1,601,408.95	597,833.24	2,718.17	-1,060.04
1,598,690.78	598,893.28	0	0
1,598,764.92	600,372.94	74.14	1,479.66
1,598,673.72	601,702.01	- 17.06	2,808.73
1,598,558.23	603,121.63	- 132.55	4,228.35
1,598,620.54	604,342.10	- 70.24	5,448.82
1,602,619.58	603,105.88	3,928.80	4,212.60
1,603,883.69	604,477.93	5,192.91	5,584.65
1,603,974.57	603,201.03	5,283.79	4,397.75
1,603,943.73	601,667.89	5,252.95	2,774.61
1,603,970.63	600,517.30	5,279.85	1,624.02
1,602,711.12	599,161.00	4,020.34	267.72
1,604,152.39	595,950.37	5,461.61	-2,942.91
1,604,130.41	594,357.85	5,439.63	-4,535.43
1,609,341.37	600,652.47	10,650.59	1,759.19
1,593,499.50	596,242.36	-5,191.28	-2,650.92

[illegible]

TABLE XXVII--Continued

Corrected Local Coordinates		Corrected Observed Coordinates	
E	N	E	N
-5,222.98	5,511.13	1,593,467.80	604,404.41
-5,237.02	4,130.15	1,593,453.76	603,023.43
-3,930.77	4,184.95	1,594,760.01	603,078.23
-5,233.23	2,851.69	1,593,457.55	601,744.97
-5,312.14	1,343.67	1,593,378.64	600,236.95
-5,246.88	200.55	1,593,443.90	599,093.83
-3,952.11	266.53	1,594,738.67	599,159.81
-5,250.49	-1,096.00	1,593,440.29	597,797.28
-5,268.95	-3,797.27	1,593,421.83	595,096.01
-5,286.27	-5,133.84	1,593,404.51	593,759.44
-2,888.15	-1,079.24	1,595,802.63	597,814.04
-1,287.34	-1,134.83	1,597,403.44	597,752.45
- 43.90	-5,122.90	1,598,646.88	593,770.38
48.90	-3,830.27	1,598,739.68	595,063.01
57.77	-2,513.13	1,598,748.55	596,380.15
63.66	-1,141.74	1,598,754.44	597,751.54
1,667.87	-1,182.60	1,600,358.65	597,710.68
2,685.04	-1,140.71	1,601,375.82	597,752.57
0	0	1,598,690.78	598,893.28
118.32	1,476.65	1,598,809.10	600,369.93
66.89	2,807.74	1,598,757.67	601,701.02
- 6.11	4,230.05	1,598,684.67	603,123.33
92.65	5,448.01	1,598,783.43	604,341.29
4,052.60	4,092.93	1,602,743.38	602,986.21
5,357.04	5,426.46	1,604,047.82	604,319.74
5,409.71	4,147.53	1,604,100.49	603,040.81
5,333.07	2,616.13	1,604,023.85	601,509.41
5,325.56	1,465.35	1,604,016.34	600,358.63
4,018.19	147.42	1,602,708.91	599,040.70
5,370.73	-3,104.57	1,604,061.51	595,788.71
5,301.17	-4,695.58	1,603,991.95	594,197.70
10,697.47	1,439.93	1,609,388.25	600,333.21
-5,267.73	-2,494.35	1,593,423.05	596,398.93

BIBLIOGRAPHY

BIBLIOGRAPHY		BIBLIOGRAPHY	
A	E	E	K
10.100.100	05.100.100.1	01.100.1	05.100.1
11.100.100	06.100.100.1	02.100.1	06.100.1
12.100.100	07.100.100.1	03.100.1	07.100.1
13.100.100	08.100.100.1	04.100.1	08.100.1
14.100.100	09.100.100.1	05.100.1	09.100.1
15.100.100	10.100.100.1	06.100.1	10.100.1
16.100.100	11.100.100.1	07.100.1	11.100.1
17.100.100	12.100.100.1	08.100.1	12.100.1
18.100.100	13.100.100.1	09.100.1	13.100.1
19.100.100	14.100.100.1	10.100.1	14.100.1
20.100.100	15.100.100.1	11.100.1	15.100.1
21.100.100	16.100.100.1	12.100.1	16.100.1
22.100.100	17.100.100.1	13.100.1	17.100.1
23.100.100	18.100.100.1	14.100.1	18.100.1
24.100.100	19.100.100.1	15.100.1	19.100.1
25.100.100	20.100.100.1	16.100.1	20.100.1
26.100.100	21.100.100.1	17.100.1	21.100.1
27.100.100	22.100.100.1	18.100.1	22.100.1
28.100.100	23.100.100.1	19.100.1	23.100.1
29.100.100	24.100.100.1	20.100.1	24.100.1
30.100.100	25.100.100.1	21.100.1	25.100.1
31.100.100	26.100.100.1	22.100.1	26.100.1
32.100.100	27.100.100.1	23.100.1	27.100.1
33.100.100	28.100.100.1	24.100.1	28.100.1
34.100.100	29.100.100.1	25.100.1	29.100.1
35.100.100	30.100.100.1	26.100.1	30.100.1
36.100.100	31.100.100.1	27.100.1	31.100.1
37.100.100	32.100.100.1	28.100.1	32.100.1
38.100.100	33.100.100.1	29.100.1	33.100.1
39.100.100	34.100.100.1	30.100.1	34.100.1
40.100.100	35.100.100.1	31.100.1	35.100.1
41.100.100	36.100.100.1	32.100.1	36.100.1
42.100.100	37.100.100.1	33.100.1	37.100.1
43.100.100	38.100.100.1	34.100.1	38.100.1
44.100.100	39.100.100.1	35.100.1	39.100.1
45.100.100	40.100.100.1	36.100.1	40.100.1
46.100.100	41.100.100.1	37.100.1	41.100.1
47.100.100	42.100.100.1	38.100.1	42.100.1
48.100.100	43.100.100.1	39.100.1	43.100.1
49.100.100	44.100.100.1	40.100.1	44.100.1
50.100.100	45.100.100.1	41.100.1	45.100.1
51.100.100	46.100.100.1	42.100.1	46.100.1
52.100.100	47.100.100.1	43.100.1	47.100.1
53.100.100	48.100.100.1	44.100.1	48.100.1
54.100.100	49.100.100.1	45.100.1	49.100.1
55.100.100	50.100.100.1	46.100.1	50.100.1
56.100.100	51.100.100.1	47.100.1	51.100.1
57.100.100	52.100.100.1	48.100.1	52.100.1
58.100.100	53.100.100.1	49.100.1	53.100.1
59.100.100	54.100.100.1	50.100.1	54.100.1
60.100.100	55.100.100.1	51.100.1	55.100.1
61.100.100	56.100.100.1	52.100.1	56.100.1
62.100.100	57.100.100.1	53.100.1	57.100.1
63.100.100	58.100.100.1	54.100.1	58.100.1
64.100.100	59.100.100.1	55.100.1	59.100.1
65.100.100	60.100.100.1	56.100.1	60.100.1
66.100.100	61.100.100.1	57.100.1	61.100.1
67.100.100	62.100.100.1	58.100.1	62.100.1
68.100.100	63.100.100.1	59.100.1	63.100.1
69.100.100	64.100.100.1	60.100.1	64.100.1
70.100.100	65.100.100.1	61.100.1	65.100.1
71.100.100	66.100.100.1	62.100.1	66.100.1
72.100.100	67.100.100.1	63.100.1	67.100.1
73.100.100	68.100.100.1	64.100.1	68.100.1
74.100.100	69.100.100.1	65.100.1	69.100.1
75.100.100	70.100.100.1	66.100.1	70.100.1
76.100.100	71.100.100.1	67.100.1	71.100.1
77.100.100	72.100.100.1	68.100.1	72.100.1
78.100.100	73.100.100.1	69.100.1	73.100.1
79.100.100	74.100.100.1	70.100.1	74.100.1
80.100.100	75.100.100.1	71.100.1	75.100.1
81.100.100	76.100.100.1	72.100.1	76.100.1
82.100.100	77.100.100.1	73.100.1	77.100.1
83.100.100	78.100.100.1	74.100.1	78.100.1
84.100.100	79.100.100.1	75.100.1	79.100.1
85.100.100	80.100.100.1	76.100.1	80.100.1
86.100.100	81.100.100.1	77.100.1	81.100.1
87.100.100	82.100.100.1	78.100.1	82.100.1
88.100.100	83.100.100.1	79.100.1	83.100.1
89.100.100	84.100.100.1	80.100.1	84.100.1
90.100.100	85.100.100.1	81.100.1	85.100.1
91.100.100	86.100.100.1	82.100.1	86.100.1
92.100.100	87.100.100.1	83.100.1	87.100.1
93.100.100	88.100.100.1	84.100.1	88.100.1
94.100.100	89.100.100.1	85.100.1	89.100.1
95.100.100	90.100.100.1	86.100.1	90.100.1
96.100.100	91.100.100.1	87.100.1	91.100.1
97.100.100	92.100.100.1	88.100.1	92.100.1
98.100.100	93.100.100.1	89.100.1	93.100.1
99.100.100	94.100.100.1	90.100.1	94.100.1
100.100.100	95.100.100.1	91.100.1	95.100.1

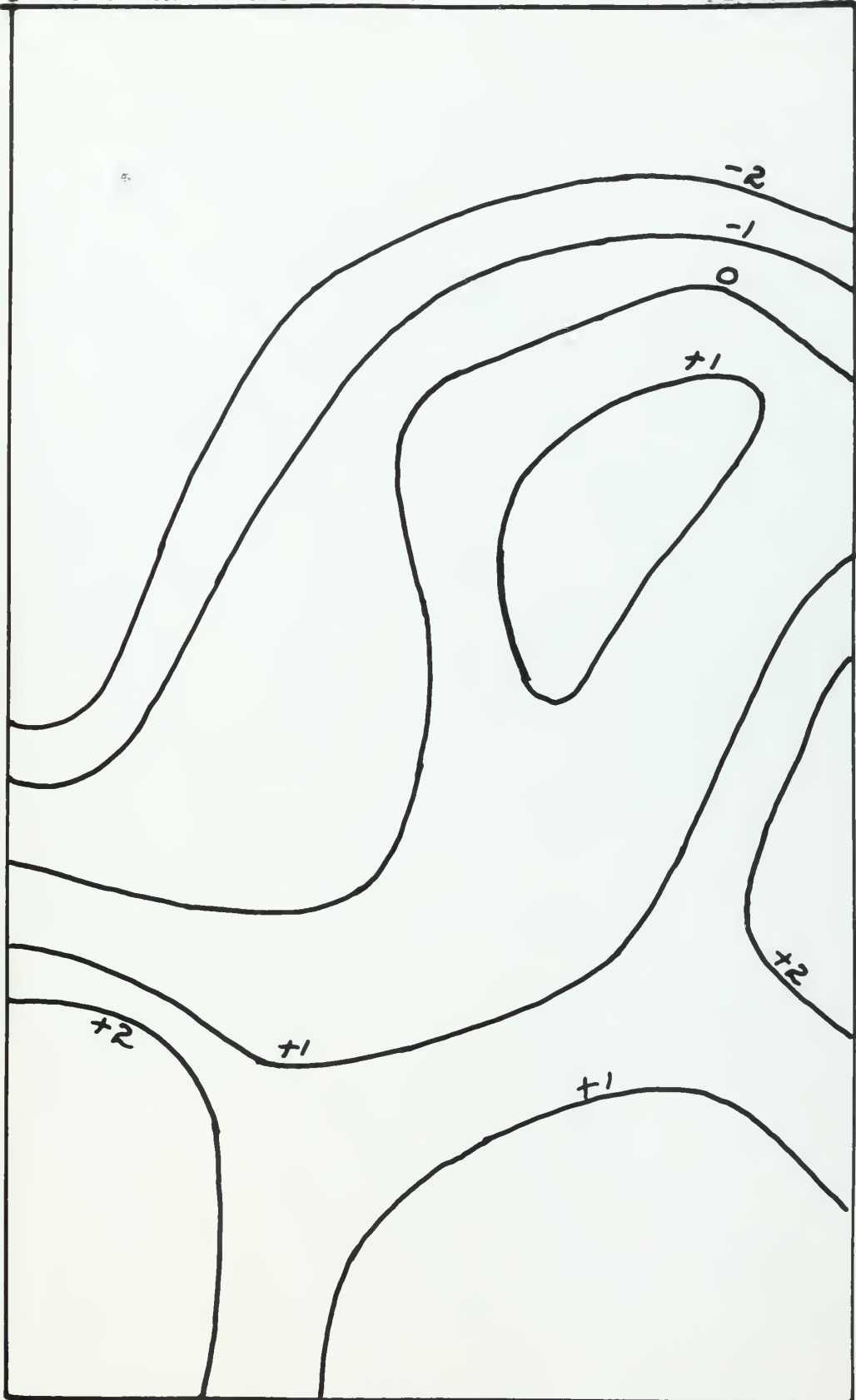
TABLE XXVII—Continued

Errors of Observations		
N(ft)	N(ft)	Z(ft)
+3.99	-0.53	0.3
+2.43	+0.28	-1.6
+3.08	+1.28	-0.2
+3.85	+0.06	-1.4
+3.53	-0.78	-1.4
+1.02	+0.18	-3.7
+0.53	+0.60	-3.5
+2.02	-0.24	-6.9
+0.60	-2.22	-9.6
-1.81	-2.14	-9.4
X	-0.26	-2.4
-0.86	-1.61	-0.6
-4.22	-2.72	X
-1.06	-0.88	3.0
-1.31	-0.38	2.9
-0.52	-0.68	0.7
-2.51	X	3.8
-3.15	-0.13	3.9
0	0	0.1
-1.14	+1.07	-0.7
-0.81	-0.36	0.8
+0.65	+0.86	-1.2
-2.93	+0.49	-3.3
-3.35	+1.89	1.5
-1.80	+1.93	-2.4
-3.44	+1.89	1.9
-1.65	+1.30	-1.0
-1.96	+1.05	-1.4
X	+1.12	1.9
-4.48	+0.61	-0.5
-5.91	+2.90	X
-3.54	+0.65	2.9
+1.26	-2.30	-4.2

X Apparent observation error.

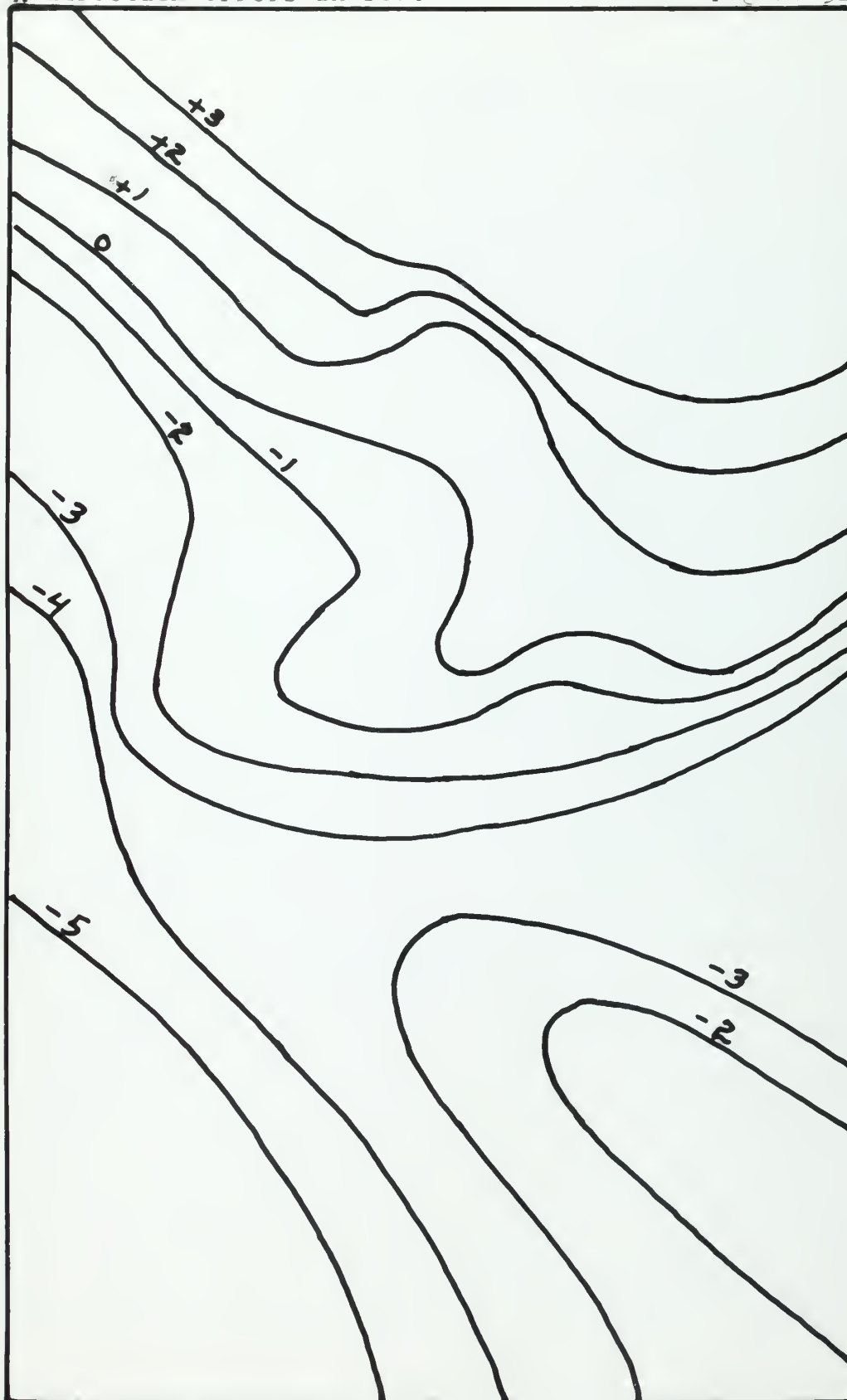
TABLE 1. — *Continued*

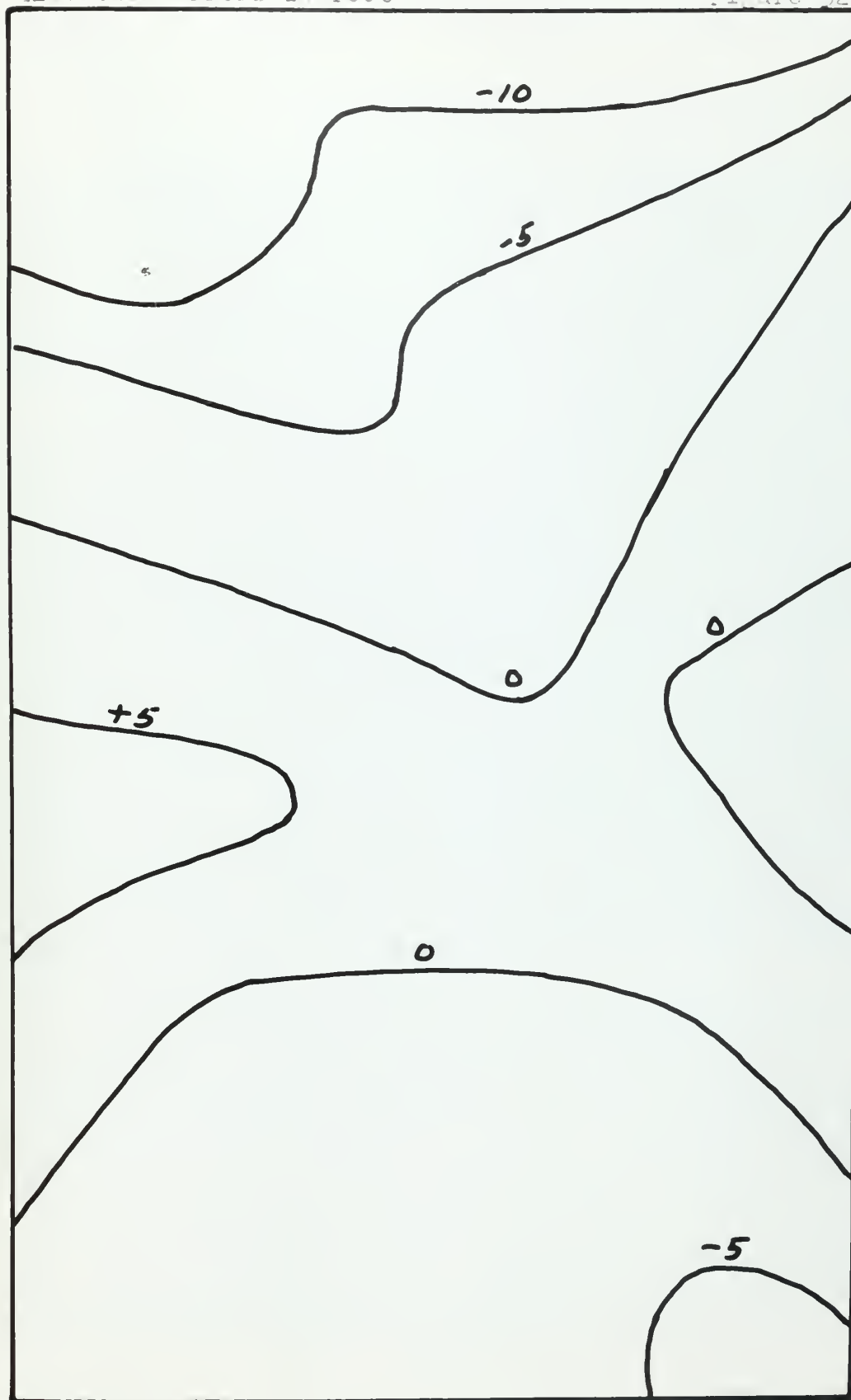
Number of specimens		
(1)	(2)	(3)
100	100.0	100.0
90	90.0	90.0
80	80.0	80.0
70	70.0	70.0
60	60.0	60.0
50	50.0	50.0
40	40.0	40.0
30	30.0	30.0
20	20.0	20.0
10	10.0	10.0
0	0.0	0.0
100	100.0	100.0
90	90.0	90.0
80	80.0	80.0
70	70.0	70.0
60	60.0	60.0
50	50.0	50.0
40	40.0	40.0
30	30.0	30.0
20	20.0	20.0
10	10.0	10.0
0	0.0	0.0
100	100.0	100.0
90	90.0	90.0
80	80.0	80.0
70	70.0	70.0
60	60.0	60.0
50	50.0	50.0
40	40.0	40.0
30	30.0	30.0
20	20.0	20.0
10	10.0	10.0
0	0.0	0.0
100	100.0	100.0
90	90.0	90.0
80	80.0	80.0
70	70.0	70.0
60	60.0	60.0
50	50.0	50.0
40	40.0	40.0
30	30.0	30.0
20	20.0	20.0
10	10.0	10.0
0	0.0	0.0
100	100.0	100.0
90	90.0	90.0
80	80.0	80.0
70	70.0	70.0
60	60.0	60.0
50	50.0	50.0
40	40.0	40.0
30	30.0	30.0
20	20.0	20.0
10	10.0	10.0
0	0.0	0.0
100	100.0	100.0
90	90.0	90.0
80	80.0	80.0
70	70.0	70.0
60	60.0	60.0
50	50.0	50.0
40	40.0	40.0
30	30.0	30.0
20	20.0	20.0
10	10.0	10.0
0	0.0	0.0



X-direction errors in feet

Figure 31





CONCLUSIONS

Assuming that the lens used in the photography measured is comparable to the average lens computed, a comparison of errors can be made, inasmuch as the elevation, 13,750', is approximately equal to the 4,000 m elevation assumed for other computations.

As is obvious from the difference in magnitude and pattern of error, the lack of a true spatial model prevents any meaningful comparison. With the exception of corner points, the elevation errors obtained were relatively close to being within the maximum computed for the average lens, however the range of errors was greater than computed for the average lens. The X-direction errors bore no resemblance to the computed graphs in either pattern or magnitude. The Y-direction errors cannot be computed, as previously discussed, due to the lack of ability to predict just where along the line between the two images, as separated by parallax, the point would be chosen. The magnitude of Y-direction errors, measured in the actual photography, is considerably less than the X-direction and elevation errors measured. The maximum predominant error in all coordinates was approximately 5 feet, which would put the accuracy at one part in 2,750 parts of elevation above the terrain. This accuracy would only be acceptable for most mapping requirements if flown at very low altitude above the terrain and controlled by

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sufficient geodetic control or by high altitude normal angle photography.

Without the ability to obtain a true spatial model in the stereo plotter, the relatively high accuracy as computed for the X values of the average lens will not be achieved. Any tendency to warp the model to eliminate the parallax caused by lens distortion will tend to decrease the X coordinate accuracy. The elevation accuracy is also adversely affected by this warping but not to the same extent. The plus to minus range of errors is increased considerably but absolute errors are not increased too greatly. The Y -direction errors which would be obtained with a true spatial model would probably not be too great but cannot be predicted due to the range of possibilities of Y -positions due to parallax. The maximum of 15 microns parallax computed for the average lens would create a maximum Y -direction error of approximately one part in 10,000 of elevation above terrain. Thus to map with the above photographs taken at 13,000 feet above the terrain, the maximum mapping scale which could be used with mapping accuracy of 0.2 mm would be 1:6,000.

Thus metrogon photography is suitable for low altitude mapping with the altitude determined by the mapping accuracy required, but is not suitable for any control extension work. The only case in which metrogon photography would be suitable would be in case the distortion curve of the lens used was sufficiently close to the metrogon correction plates to be used to bring uncompensated errors throughout the model area to less than 10 microns.

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